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*Surry, England.*

**ADMINISTRATION REPORT**

OF THE

**DEPARTMENT OF AGRICULTURE  
IN MESOPOTAMIA.**

*For the year 1920.*

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BAGHDAD:  
PRINTED AT THE GOVERNMENT PRESS.  
1921.





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# ADMINISTRATION REPORT OF THE DEPARTMENT OF AGRICULTURE IN MESOPOTAMIA, 1920.

## I.—ADMINISTRATION.

### A.—INTRODUCTORY REMARKS.

1. The year under review is one that will stand out prominently in the history of agricultural development in Mesopotamia as it will in the annals of the Administration of the country as a whole. The year opened with a projected programme which showed every promise of bringing the Agricultural Department into line with similar Departments in the East. Experimental Farms were established where work of value was being conducted to solve some of the multifarious problems that need investigation. The Central Experimental Farm and Estate at Rustam, on the Diala, was in course of preparation to receive the 1920 winter crops. Plans for the Agricultural College and Research Institute at Rustam were ready and contracts for the erection of the buildings were about to be placed. With the outbreak of the Arab Nationalist Movement in June, 1920, work had to be suspended on two of the Experimental Farms as well as on the Central Farm and Agricultural College.

2. Orders were received that in the interests of economy the staff of the Department must be reduced commensurate with reduction of staff in other Departments. In support of the retention of the whole of the staff the plea was advanced that rather than dispense with the services of the trained technical staff it would be advisable, owing to the world shortage of men of the required training, to lend the services of a part of the staff, as a temporary measure, for Military duty. This was agreed to.

The following Officers:—

Mr. R. R. Anson,

Mr. G. S. Cameron, M.C.,

Mr. W. D. Garbutt,

Mr. A. G. Noble, and

Mr. C. L. White

were asked to express their willingness or otherwise to revert temporarily to Military duty. It is a source of considerable pride and of pleasure to be able to record that each of these officers volunteered to undertake any form of Military duty at the discretion of the Military authorities. During the delay that ensued before any definite further action was taken the Arab insurrection was suppressed, and the staff of the Department remains practically intact.

The year has been one of abnormal vicissitudes; and of occasional very anxious moments. Yet, despite these, genuine progress has been made.

3. During the War there existed in Mesopotamia a Military organisation designated "The Agricultural Development Scheme." Its main function was to increase the production of cereals within the country. Subsequent to the Armistice this organisation has been replaced by the Civil Agricultural Department which, on the constitution of a National Government towards the end of the year under review, was brought under the jurisdiction of the Ministry of the Interior. The main lines of work undertaken have been (a) an enquiry into the agricultural practices and customs in vogue; (b) experimental work with different varieties of cotton and wheat to discover those best suited to the country; (c) the demonstration of the uses of labour-saving machinery in co-operation with the Mesopotamian agents for the manufacturers; (d) soil survey of part of the area irrigated by canals taking off from the River Diala; (e) study of insect pests and diseases of plants; and (f) advice to cultivators on general matters pertaining to agriculture.

4. It will be noted that the work undertaken does not include agriculture propaganda of any description. The reason for this is that experimental work with cotton, wheat and barley varieties was still in the experimental stage. It was only after three years' experimental work with cotton that we were in a position to decide the variety of cotton which should be cultivated to the exclusion of all others.



In 1921 propaganda work concerning the cultivation of this particular variety of cotton is being undertaken for the first time. It is firmly believed that the cultivation of cotton on a large scale will go far towards solving the difficult political situation that now has the tendency to arise every year during the summer months. Despite the availability of land, labour, and water, it is significant that no crop of economic importance is grown during these months over large areas of irrigable land. The spring crop of cereals is harvested; the full time of the cultivator will again be occupied not until the subsequent winter sowing time; with, temporarily, no crops to maintain his interest—financial and otherwise—he takes to tribal raiding as a diversion. The cultivation of cotton throughout the summer months, as revealed in the Report of the Cotton Expert, will in all probability go far towards changing this order of things.

## B.—STAFF

5. Doctor R. J. D. Graham continued as Director of Agriculture until 26th July when he availed of six months' leave. During his absence Mr. R. Thomas officiated as Director of Agriculture in addition to his duties as Cotton Expert.

6. Mr. G. S. Cameron, M.C., held the post of the Deputy Director of Agriculture throughout the year. Mr. J. F. Webster, officiated as Deputy Director of Research in addition to his duties as Agricultural Chemist during the period that Mr. R. Thomas officiated as Director of Agriculture.

7. Mr. R. R. Anson remained in charge of the Mosul Circle, Mr. W. D. Garbutt of the Lower Tigris Circle, and Mr. C. Gautby of the Diala Circle throughout the year. Mr. C. L. White first reported for duty on 18th May. On 24th July, 1920 he was posted to the Euphrates Circle, but owing to the Arab disturbances this Circle was closed down and he was transferred to take charge of the Central Farm at Rustam in October. Mr. Nelson Porter was mainly engaged in the erection of temporary buildings at Rustam in co-operation with the Public Works Department. The services of Mr. A. G. Noble, Superintendent, Central Farm, were dispensed with on 16th October owing to reduction of establishment. Mr. V. H. W. Dowson availed of two years' leave on 26th July with the object of pursuing a course in plant genetics at the Cambridge University. Mr. C. R. Wimshurst relinquished his appointment as Government Entomologist in May.

8. Mr. A. E. Kinch, on return from leave on April 8th was placed in charge of the Experimental Farm at Shergat. On this farm being closed down he was appointed Assistant Circle Officer Lower Tigris. Mr. A. J. Glenister, Arboriculturist, availed of two months' leave on 27th July. Mr. H. G. D. Rooke, continued as Personal Assistant to the Director throughout the year. Mr. W. Allen, Manager of the Tel Deir Cotton Estate relinquished his appointment in the Department on 27th July.

9. Of Part II Gazetted Officials, Rao Saheb, Y. Ramchandra Rao, (Assistant Entomologist), Mr. B. Viswanath (Assistant Chemist), Mr. S. R. Venkata-Krishna Mudaliar, (Assistant Mycologist) reverted to the Madras Provincial Service on expiry of the period of their deputation in December. Mr. H. P. Paranjpye (Assistant Botanist) was permitted by the Government of Bombay to extend the period of his deputation by 3 months. Mr. (now Khan Saheb) A. A. Soofee, on return from leave in India on February 29th re-assumed charge of the Cotton Farm, Baghdad, from Mr. Ghulam Hussain who undertook charge during Mr. Soofee's absence. On 8th July Mr. Ghulam Hussain took over charge of the Tel Deir Cotton Estate from Mr. Allen. He availed of two months' leave in India on 27th December.

## II.—RESEARCH.

### A.—GENERAL REMARKS.

10. Except for the restricted touring necessitated by the insecure state of the country during the summer months, the work of the Scientific Staff was continued unchecked. Material progress has already been made in our knowledge of insect pests and plant diseases as well as in the important problems concerned with saline lands.

11. In response to a request made to the Government of India, the Provincial Government of Bombay very kindly deputed one, and that of Madras three, scientific assistants for one year. On the expiry of this period all four Assistants expressed their desire to revert to India where the prospects of men of their training and qualifications had considerably improved during the re-organisation that ensued subsequent to their deputation. In order that the work might continue, the vacant posts were adver-



tised in the Indian Press. The Agricultural Adviser to the Government of India kindly agreed to interview and to select those short-listed for the vacancies in the Entomological, the Chemical and the Botanical Sections. It was decided to defer, for the time being, the appointment of an Assistant Mycologist whose work will temporarily be undertaken by the Botanical Section. The three appointed Scientific Assistants have now arrived.

I here wish to record our sense of gratitude to the Agricultural Adviser to the Government of India for his kind assistance in this as well as in other matters; and to the Indian Provincial Departments—more especially those of Madras, the Punjab and Bombay—for their invaluable help. With their assistance it has been possible to form the nucleus of a laboratory and to have initiated agricultural research work on a high standard of efficiency.

12. During the year Mr. B. Viswanath was deputed to India to purchase enough laboratory apparatus and reference books to meet the more urgent needs of the Research Section. That portion of our demands which was not available in India was ordered from England. Most of it has now arrived.

13. The Scientific laboratories are comprised of four small rooms specially fitted as a temporary measure to carry on routine work pending the erection of the proposed Research Institute. In so far as the Agricultural Department is concerned the unavoidable postponement of the erection of this building on the plea of economy was the severest blow received in consequence of the Arab Insurrection of 1920. The statement perhaps justifies repetition that only after continued research and enquiry into existing practices and problems will we be in a position to effect or even to recommend radical improvements in the agriculture of the country. Progress is of necessity considerably impaired where accommodation and material are limited to the degree that they now are.

NOTE.—Subsequent to the drafting of this Report sanction has been accorded to the erection of the proposed Agricultural Research Institute and Training College.

#### B.—AGRICULTURAL EDUCATION.

14. There is an insistent demand amongst 'Iraq landowners that their sons might learn what are commonly known as "Improved methods of Agriculture." It has been the custom for many years for the more wealthy townspeople to send their children to India, Europe or Syria to be educated. These townspeople are in many cases landed proprietors. With the boom that these anticipate as the result of increased security to life and property consequent on the establishment of a stable Government, it is natural that they should seek means of developing their estates to the utmost capacity. It was the proposal of Dr. Graham, the Director of Agriculture, that the proposed Research Institute should combine the function of scientific investigation into agricultural problems with that of a Training College for sons of Sheikhs and other landowners. Those trained students who did not return to the land could be absorbed into the Agricultural Department as Managers of Experimental Farms and Demonstrators. At present all the technical staff has, of necessity, to be imported. Not until facilities will be provided to train the required technical staff will it be possible to replace the present staff with residents of the country. The only alternative which can, as a temporary measure, meet the situation, is to depute a few selected candidates for training in the Egyptian Agricultural College. A start has been made on these lines by deputing an intelligent Arab to study the silk industry in Kashmir with the view to introducing improvements into this industry in Mesopotamia.

Without in any way desiring to criticise the excellent work that has been, and is being, done by a sister Department it would appear, *prima facie*, that in a country which is essentially agricultural, nature study should find a very conspicuous rôle in the school curriculum. The main difficulty, I am given to understand, is the dearth of a teaching staff which takes the least interest in "nature" in so far as it is concerned with agriculture. The difficulty could, at least in part, be met were the facilities at hand to instruct these teachers in the rudiments of agricultural practices. The Agricultural Department cannot hope to give much assistance in solving this important problem until the proposed Training College for Agriculturists has been erected.

#### C.—CHEMICAL SECTION.

15. Work in this section started in earnest only in May on the return of Mr. Viswanath from India with the essential apparatus and chemicals. Since then the work has progressed uninterrupted. A certain amount of routine analyses of soils, water and crops have been done. But the main lines of work in this Section have been (a) an investigation of the salt problem and (b) a systematic soil survey of the country.



In regard to the salt problem, there are large tracts of irrigated land in the 'Iraq which are already suffering from the effects of alkalinity; and there are still larger tracts which are becoming dangerously saline. There is at present no systematic drainage. In all canals constructed during and subsequent to the War, provision has been made on the contour survey map for a complete drainage system for each canal. Owing to the capital expenditure involved no drainage channels have yet been constructed; and in the absence of a comprehensive drainage scheme the fate of lands irrigated by these canals cannot but follow that of lands irrigated by the older canals in being rendered unprofitable to cultivate at no distant date.

As a first contribution towards the systematic soil survey of the 'Iraq, that of the irrigated area on the Right Bank of the River Diala was completed. Apart from the necessity for drainage the more urgent needs of the cultivated lands in this area are an increase in the organic matter and nitrogen contents of the soil. This could be effected by introducing into the existing rotation of crops a green manure crop.

Other points of special interest revealed by the investigations of the Chemical Section are (a) that the most commonly occurring salts in the soils analysed were the sulphates and chlorides of Sodium, Magnesium and Calcium. There is a conspicuous absence of Black Alkali (Sodium Carbonate), a salt which, even in small quantities, inhibits all plant growth and is, in addition, most difficult to wash free from the soil which it impregnates. And (b) that river water in the 'Iraq often contains as much as 100 parts of water-soluble matter in 100,000. The quantity of salt left by irrigation water after evaporation may be gauged from the fact that an acre of land which is continuously cropped for twelve months, and which has no drainage, will have received during that period about five tons of salt from river water only. The enormity of this accumulation of salt points to the necessity of constructing at the inception of any new irrigation scheme a corresponding drainage scheme.

#### D.—ENTOMOLOGICAL SECTION.

16. Entomological work throughout the year was comprised chiefly of the study, the collection, the mounting, and when possible the identification, of insects of economic importance. A large collection has already been made. Specimens of each variety have been sent to various specialists for identification. It is probable that this collection will be found to be rich in species of insects new to science. Much valuable information has been collected regarding the life-histories of many of the more common insect pests. This study is a necessary preliminary to the adoption of control or preventative measures in combating the attack of most insects whose complete life-history has not already been thoroughly investigated. The object of such study is to discover the most vulnerable stage in the life-history of the pest.

17. A number of demonstrations to show the value of spraying as a remedy for certain insect pests was undertaken during the year near Baghdad. One owner of a local fruit garden has now adopted at his own expense this method of controlling an outbreak of aphids.

18. There are four insect-pests whose control is of considerable economic importance to the country. These are (1) *Locusts* (a separate paragraph is allotted to these. See para. 57 below). (2) The *Hamra* and *Hashaf* diseases (*Ephestia Cautella*) of dates. It is impossible to estimate the loss due to this pest. But the loss may be roughly gauged from the fact that the intensity of the annual attack primarily determines the degree of success of the date crop. In a year of bad attack thousands of immature, grub-eaten dates may be found under every palm tree in bearing. During the War the services of Captain P. A. Buxton, R.A.M.C., were temporarily lent to the Agricultural Directorate to investigate this pest. His preliminary short note on "*The failure of the Date Crop in 1918*" has now been supplemented by a valuable contribution to our knowledge of various date pests in *The Bulletin of Entomological Research*, December, 1920. Reliable methods of control of the *Hamra* and *Hashaf* diseases remain to be discovered. One of the main lines of work of the Entomological Section should be to concentrate on this problem. (3) The *Sun* pest of wheat (*Eurygaster* sp.) has been discovered to do a considerable amount of damage to the unirrigated wheat crops in the submontane tracts in Northern Mesopotamia. It is a common pest in similar areas in Russia, Turkestan and Persia. (4) The *cotton boll-worm*. (*Earias Insulana*). This pest was discovered to infest practically every crop of cotton inspected by the Cotton Expert on his first arrival in the country in 1917. In the earlier part of the season it breeds in the pods of the vegetable known as "ladies finger" (*Hibiscus Esculentus*, Arabic: *Bamia*), and it is only late in the season that the cotton crop is affected. The life-history of this insect has been thoroughly investigated in other countries.



Reliable preventative measures of control have not been discovered as yet. But the intensity of the attack can be diminished by removing all parts of the cotton plant and of "bamia" from the field as early as practicable and burning them during the winter months.

19. It is pleasing to be able to record that no evidence has yet been discovered of the Pink Boll Worm of cotton (*Ephestia Gossypiella*) which is exceedingly destructive to the cotton crop in India, Egypt and latterly in America. All cotton seed imported by the Agricultural Department into Mesopotamia has been doubly fumigated. Regulations are in force prohibiting the importation of cotton seed by private agency. But the danger lies not so much in seed imported for use in Mesopotamia as in seed imported through Mesopotamia into Persia. A concrete instance was brought to our notice of small quantities of seed of Egyptian varieties being imported for trial in Persia during the year under review. The authorities concerned were advised to burn all of this seed in the absence of a certificate to the effect that the seed had been suitably fumigated.

20. Though not directly concerned with the programme of the Agricultural Department reference may here be made to the valuable contribution to our knowledge of the Mammals of Mesopotamia by Captain R. E. Cheesman, formerly of the Agricultural Department, in Vol. XXVII of the Journal of the Bombay Natural History Society.

#### E.—BOTANICAL SECTION.

21. In this Section the most important work undertaken has been the systematic collection of specimens of all wheat and barley varieties grown in Mesopotamia, and the propagation of these at the Cotton Farm, Baghdad, together with a large number of English and Australian varieties kindly supplied by Mr. F. L. Engledow from the Plant Breeding Station, Cambridge University. The collection of the 'Iraq varieties was undertaken by Dr. Graham and Mr. C. R. Wimshurst. The latter was entrusted with the propagation of all varieties. Before availing of leave Dr. Graham took considerable trouble to separate and to describe representative ear-heads of each type represented.

22. A noticeable feature of all 'Iraq varieties of wheat is their susceptibility to the attack of Rust and more especially to that of Brown Rust (*Puccinia Glumarum*). In our search for the variety of wheat best suited for cultivation in the 'Iraq our desideratum is a rust-resistant, early-maturing, heavy yielding, variety. But not until comprehensive varietal tests have been conducted for a number of years will we be able to speak with any degree of finality regarding the varieties best suited for cultivation.

23. Realising the importance of wheat and barley cultivation to the country, and the necessity for a suitably qualified officer who could devote the greater part of his time to selection, and plant breeding, Professor R. H. Biffen, M.A., F.R.S., of the School of Agriculture, Cambridge, was asked to select and train a candidate with this object in view. A suitable candidate was not forthcoming, so it was decided to appoint temporarily Mr. L. W. Thompson, a graduate of Dublin University, who will be entrusted with the work pending the return of Mr. V. H. W. Dowson who is now undergoing a course of study in plant genetics at Cambridge.

24. The Assistant Botanist was mainly engaged in the collection and mounting of plant specimens. Duplicates of these, together with the collection made by Dr. Graham have been despatched to Kew and to Poona for identification. In addition, he has prepared interesting notes on Agricultural practices in the neighbourhood of Baghdad.

#### F.—MYCOLOGICAL SECTION

25. The year's work consisted chiefly in the identification of various fungoid diseases of crops. Those of greatest economic importance are:—

*Loose Smut* (*Ustilago tritici*) in barley.

*Rust* (*Puccinia* spp.) in wheat.

*Short Smut and Long Smut* in the Sorghums (Arabic: *dukhn.*), both indigenous and exotic.

*Late Blight* (*Helminthosporium teres*) in barley.

*Die-back* in Citrus fruit-trees.

*Leaf-Spot* (*Cercospora viticola*) in grape vines.

*Leaf Curl* in peach and nectarine trees caused by the fungus *Eroascus deformans*.



A series of spraying experiments were carried out with lime-sulphur spraying mixture to determine the concentration of the mixture which could be used without detriment to various fruit trees infested with fungoid diseases.

### G.—SERICULTURE.

26. Sericulture is a cottage industry which is capable of very considerable expansion in the 'Iraq. Previous to the War, in 1914, the industry though relatively small, was in a flourishing condition. During the war the annual supply of silk worm eggs from the South of Asia Minor was discontinued, and the industry came practically to a stand-still. In almost all of those villages in Upper Mesopotamia which enjoy a perennial flow of water the mulberry may be found. It is on the leaves of this tree that the silk worms are reared. The main centre of the industry was along the banks of the Diala. The villages of Mendali, Bedra and Sulaimani also contributed their quota.

27. In the absence of a trained staff of demonstrators it was decided to confine sericultural work to the purchase of silk-worm eggs in France, in response to the demand for eggs from the above mentioned tract. Six hundred ounces of eggs were imported, sufficient for 1,200 families. During the disturbances it was impossible to maintain touch with those who were supplied with eggs. When it again became possible to visit these villages all the villagers concerned, with the single exception of one Arab notable near Baghdad, swore that either the eggs had failed to hatch or that the rebels had stolen the cocoons. In a laboratory test practically all the eggs hatched. The small consignment of cocoons available near Baghdad was purchased with the view to having it reeled and spun by the Sericulture Department in Kashmir. More than two-thirds of the cocoons had been rendered useless as a result of their being punctured by mice.

28. It was proposed to appoint a Sericulturist with a small staff of Indian demonstrators to foster silk production on modern lines but this scheme had to be abandoned on the plea of economy.

29. In order, therefore, to give the industry a reasonable chance of reviving, and of introducing improvements into methods of rearing the silk worms, reeling the cocoons, spinning the silk etc. it was finally decided to depute an intelligent young Arab-Sayid Ebrahim Effendi—for a period of six months to undergo a course of training in sericulture under Mr. M. L. Macnamara the Director of Sericulture, Kashmir. On the expiry of the period of his deputation he will, on his return, bring with him sets of reeling machines, breeding trays and other appliances. We owe a debt of gratitude to Mr. Macnamara and to the Kashmir Government for their kind assistance.

30. The Advisory Committee on Silk Production, Imperial Institute, London, has throughout evinced a kindly interest in the production of silk in the 'Iraq. They have proffered us all possible assistance—thanks mainly to the initiative of Captain R. E. Cheesman, Private Secretary to His Excellency the High Commissioner.

## III.—EXPERIMENTAL FARMS.

### A.—GENERAL REMARKS.

31. At the opening of the year District Experimental Farms were established at Baqubah, Hilla, Kut and Shergat. The Cotton Farm, near Baghdad, was retained pending the opening of the Research Station at Rustam on the Diala. During the Arab insurrection the Baqubah and Hilla Farms had to be abandoned, together with all the experiments that had been undertaken during the summer months. The Baqubah Farm was again opened in time for the winter crop of cereals. The Hilla Farm was permanently closed down. The Shergat Farm was abandoned owing to locusts having completely destroyed all the standing crops early in the year. At Kut the water-supply failed during the summer months with the result that the experimental work with cotton was rendered valueless. At the Baghdad Cotton Farm it was possible to continue the work unhindered. At the Rustam Central Farm the land was in course of preparation for the winter crops and the construction of temporary buildings had just been commenced when persistent sniping during the night necessitated the two officers stationed there to return to Baghdad nightly for a few weeks only, but the work was continued.

This series of disasters was most unfortunate. It had been hoped that during the year statistics of considerable value would be collected on the District Farms more especially in regard to the Varietal Tests with cotton.



The necessity for replicating in out-stations part of the work done at the Cotton Farm, Baghdad for the past three years has been realised from the commencement. We are still not without hope, and the work is being repeated at Baqubah and at Kut in the coming season. Towards the end of the year the Cotton Farm was closed down owing to the impossibility of renewing the lease on the land and the experimental work has been transferred to the Central Farm at Rustam.

## B.—COTTON EXPERIMENTAL WORK.

32. A report on the 1918 and 1919 experimental work on cotton was published during the year. Embodied in that publication are detail reports received from England and India on the quality and valuation of each type of cotton grown. The outstanding feature of these reports is the excellence of the quality of cotton which can be grown in Mesopotamia. The Cotton Expert decided to repeat the experiments in 1920 before embarking on extensive propaganda amongst the cultivators. Fortunately it was possible to continue the experiments at the Cotton Farm, Baghdad; those undertaken on all the outlying Farms had to be abandoned. A perusal of the report of the Cotton Expert (Appendix VIII) will reveal the fact that he has been vindicated in his provisional decision that of the varieties of cotton under trial the one that proved to possess the best combination of characters was *Webber 49*. These characters include (a) a relatively high yielding capacity, (b) a relatively high-priced staple, (c) very large bolls from which clean cotton is easily detached, (d) its earliness of maturing and (e) its relatively high resistance to drought as compared with Egyptian varieties. Characters in which it does not excel are (a) the brittleness of its branches, and (b) its relatively low lint-outturn (ginning percentage). A start has been made in endeavouring to improve these latter characters in *Webber 49* by cross fertilisation with some of the Indo-American varieties.

33. The following varieties were included in the main varietal test for the first time—*Sudan*, *Nyasaland*, *Sunflower* (all three American or *Gossypium hirsutum* types); *Sakel-Sudan* (Egyptian, or *G. barbadense* type); and the commonly cultivated local variety—(*G. herbaceum*). There were, altogether, 17 varieties under experiment in 1920. Six varieties have been discarded since the work was first undertaken in 1918.

34. Other experiments, all of which have an important economic bearing on the development of cotton cultivation in the country, included:—

- (a) The optimum date of sowing of cotton;
- (b) An Irrigation experiment to discover the earliest date by which the watering of cotton can be economically discontinued;
- (c) Spacing experiment;
- (d) Flat *versus* Ridge system of sowing cotton;
- (e) A small scale varietal test with 23 strains of cotton selected from single plants in 1918;
- (f) The "duty of water" for the cotton crop.

35. Voluminous statistics have been collected but time has not as yet permitted for these to be investigated. A casual perusal of these records, however, reveals the exorbitant variability in the yields of plots treated identically during the year under review.

36. In regard to the "duty of water" for the cotton crop, the Irrigation Department was asked to undertake this work, but for various reasons no records have been received. An attempt to measure each watering at the Cotton Farm, initiated by the Cotton Expert with the kind assistance of Captain F. C. Glass of the Irrigation Department, reveals the fact that under the conditions obtaining at the Cotton Farm, Baghdad, the average depth of water applied at each irrigation is equivalent to approximately 4 inches of water on the field. With an average of 13 waterings the aggregate amount of water given to the cotton crop is about 52 inches during the year.

37. The selection of improved strains of cotton from the imported varieties continues.

## C.—FLAX AND LINSEED.

38. Two varieties of Linseed and five varieties of Flax were grown in very small plots at the Cotton Farm, Baghdad during the year. The Imperial Institute, London, very kindly reported on the quality of the flax straw samples sent them; and the Agricultural Chemist analysed the seed for its oil content. The seed was found to have an oil content varying from 34 to 35 per cent. as compared with 30 per cent. to 35 per cent. for Russian seed, 35.7 per cent. for Egyptian and 38 per cent. to 41 per cent. for Indian seed.

39. The flax samples were favourably reported upon but the quality of the fibre had suffered owing to the seed rate not being sufficiently heavy. In view of the indicated suitability of the flax crop for cultivation in Mesopotamia enough seed was ordered during the summer to grow about 40 acres. It was proposed to sow 20 acres in the autumn and 20 in the spring. The seed arrived too late for the autumn sowing; and it actually reached Baghdad in time for the tail end of the spring season. Some 30 acres have now been sown and the balance of the seed is being reserved for cultivation in the coming autumn.

#### D.—OTHER CROPS.

##### (a) SUGAR-CANE.

40. A number of varieties of sugar-cane were imported from the Sugar-Cane Breeding Station, Coimbatore, South India. The crop grew well despite the lack of proper treatment, but it was killed off by the early frosts in December before it had matured. The shortage of staff and of facilities for conducting suitable trials have militated against the success of the crop. In view of the fact that sugar-cane was commonly cultivated in this country in mediæval times these trials will be continued when facilities permit.

##### (b) POTATOES AND OTHER VEGETABLES.

41. A number of varieties of imported Persian and Indian potatoes were grown at the Cotton Farm, Baghdad, during the year. Almost without exception the Indian varieties gave the best results. The yield of the best varieties is low compared with those of other countries. An yield of  $2\frac{1}{2}$  tons per acre is a good crop. The Indian varieties excelled owing, it is believed, to their period of growth being appreciably shorter than that of Persian varieties. Potatoes can be grown successfully if planted during the month ending the first week in February, or as an autumn crop when planted during August.

42. Other imported vegetables which do particularly well if sown in July and transplanted in August or early September are Cabbage and Cauliflower. Peas give extraordinarily heavy yields when sown in the Spring. It is probable that this vegetable can also be grown successfully in the Autumn.

##### (c) GREEN MANURE CROPS.

43. Much work remains to be done on importing seed of various green manure crops and experimenting with these crops with the view to their introduction into the scheme of rotation with cotton and cereals. Berseem (Egyptian clover) though it serves a purpose, suffers severely during frosty weather.

### IV.—DISTRICT WORK AND DEMONSTRATION.

#### A.—GENERAL REMARKS.

44. It was this branch of work, more perhaps than any other, that one would have expected to suffer most in consequence of the Arab Insurrection during the summer months. Yet it is noteworthy that the adverse effect on the progress of the district work on hand was barely appreciable. This is mostly to be attributed to the fact that no form of propaganda had, as yet, been undertaken in agricultural improvement work amongst the cultivators. We were still in the "enquiry" or "survey" stage, except for the initial attempt to grow an improved type of cotton on a commercial basis on one site only. On the outbreak of the disturbances, therefore, there was but little at stake in recalling departmental officers temporarily to headquarters. On the disturbances being quelled in the Autumn the work was resumed.

45. In view of the diverse agricultural problems that demand investigation in the Iraq it was decided, during the year, to allocate to each of the three District Officers a special subject for enquiry. The present investigations include the economics and agricultural practices concerning date cultivation, the sheep and wool industry, the fruit industry on the River Diala, and an enquiry into the breeding of the Arab Horse. Much valuable information has already been collected and preliminary reports are ready for the Press on the first three subjects. Major C. R. Wimshurst, before relinquishing his appointment with the Government of Mesopotamia published a very useful preliminary Note on the Wheats and Barleys of the country.



## B.—COTTON CULTIVATION.

## (a) TEL DEIR COTTON ESTATE.

46. The Cotton Experimental Work that had been conducted at the Baghdad Cotton Farm during the previous two seasons was continued. It had been decided to postpone any form of advisory work amongst cotton cultivators until definite results had been obtained at the Cotton Farm and confirmed in the Experimental Stations in outlying stations. For reasons given above it has not been possible to confirm these results on the outlying farms. In the meantime a commencement had to be made in cultivating an improved type of cotton on a commercial basis. It had been hoped that this initial effort might be undertaken by a private agency as distinguished from a Government Department, but owing to the lack of security to property during the critical year under review there was no alternative but that the work should be undertaken by the Agricultural Department. Details of the work may be seen in the Report of the Cotton Expert (Appendix VIII).

47. The site selected, comprising some 200 acres and later reduced to 80 acres, was about 20 miles from Baghdad near the ancient mound of Tel Deir on the newly constructed Yusufiyah canal. The cultivators had no previous experience in cotton cultivation. An agreement was made with the Sheikh concerned that the cultivators should receive 40 per cent. of the gross value of the crop plus the cotton stalks which had a high value as fuel; the Government would take 30 per cent. as its share of revenue; the Agricultural Department would take 25 per cent. representing the share of the Capitalist; and the Sheikh should be given 5 per cent. for his assistance. The variety of cotton grown was *Webber 49*, a long-staple American cotton which has been given the commercial name of *Mesopot White*. The reasons why this variety was selected are given in the published Report of the Cotton Expert on *Cotton Experimental Work in Mesopotamia* during 1918-1919.

48. Owing to a misunderstanding, the Sheikh permitted seed of wheat and barley to be sown in the plot reserved for cotton. He later agreed to plough in the cereal crop on compensation being paid for the seed sown. A British Superintendent (later replaced by an Indian) together with two of the cultivators imported from Egypt, resided on the Estate. The progress of the work was most satisfactory until the disturbances broke out in July when the supervisory staff was recalled to Headquarters. During their absence the watering of the crop was irregular until about the middle of August and it was entirely withheld from that time. Touch was however maintained with the cultivators who were now proscribed rebels in common with most other cultivators on this canal. Thanks to the timely assistance received from Intelligence Branch, G.H.Q. it was found possible to deliver at the ginneries of the British Cotton Growing Association in Baghdad all the cotton picked during the season, amounting, in all, to about 400 camel loads. An average yield of 1,250 lbs. of seed cotton per acre was obtained.

49. It is gratifying to be able to record the success of this initial effort to cultivate cotton on a quasi-commercial basis. And it is believed that the scheme succeeded, when similar efforts of private estate owners failed, owing largely to the kindly and considerate treatment offered and eventually given to the cultivators. Had it not been for this it is doubtful if any cotton would have been delivered at the ginneries. Thus, amongst other concessions in the agreement, the cultivators were given the option of prices ruling in Baghdad, Bombay or Liverpool on the date of delivery of their cotton, as a basis for calculating the value of their share of the crop. It so happened that they procured for their 40 per cent. share based on Liverpool prices as much as they would have received for the total crop at the Baghdad Bazaar price. Each family, cultivating  $6\frac{1}{2}$  acres, was paid an average of Rs. 1,000 representing 40 per cent. of the gross value of the crop.

50. From the seed-cotton delivered enough seed has been obtained to sow about 2,000 acres in the coming season. It is of interest to note that this available seed has developed from  $1\frac{1}{2}$  lbs. in 1918 to 75,000 lbs. at the end of the 1920 season.

## (b) THE BRITISH COTTON GROWING ASSOCIATION.

51. As a direct outcome of the visit to Mesopotamia of Messrs. Crapper and Hodgkinson, the two delegates of the British Cotton Growing Association in 1919, their executive, at the invitation of the authorities concerned, decided to erect a ginnery sufficiently large to handle the whole of the 1920 and 1921 cotton crop grown from seed supplied to cultivators by the Agricultural Department. Their Engineer Mr. F. Feber arrived during the year with the necessary machinery, Mr. A. Eastwood, the Managing Agent, followed a few months later. Some time was spent in selecting a suitable site. Through the kindness of General Lubbock, C.M.G., D.S.O.,



Director of Railways, a site was selected near Baghdad West Station at a point where access is easy to the main and the feeder railway lines as well as to the main roads entering Baghdad. Buildings and machinery were erected so as to be ready to receive the crop at the end of the year.

52. I here wish to record our indebtedness to the British Cotton Growing Association generally, and in particular to Messrs. Eastwood and Feber for the material assistance which they have been so ready to give us in all matters which concern the development of cotton cultivation in the country.

53. During the year the British Chamber of Commerce in Baghdad entertained a misgiving that to entrust the erection of cotton gins and presses in Mesopotamia to one body such as the British Cotton Growing Association would perhaps not be conducive to the best interests of legitimate trade in the country. On the matter being explained to them that until cotton cultivation in the country was well established some form of Government control over gins and presses was essential, and that this could in the initial stage best be done through one agency which was prepared to forego the payment of dividends, they agreed that the work was being done so as ultimately to be in the best interests of the trade in general.

#### (c) DISTRIBUTION OF COTTON SEED AND SUPERVISION.

54. It was only in response to an insistent demand that it was eventually decided to import on behalf of three estate owners ten tons of *Sakellarides* and ten tons of *Ashmouni* from Egypt to be sown in 1920. These varieties had shown considerable promise in the 1918 and 1919 experiments. The seed was suitably fumigated before leaving Egypt and again after arrival in Baghdad. The practice of importing seed, however, is to be deprecated owing to the considerable risk of introducing with it exotic insect-pests. The seed would not have been imported in 1920, had it not been for the firmness of the demand and the desire to import it privately in the event of the Agricultural Department not undertaking the work on behalf of estate owners. This bulk importation of cotton seed has now been definitely discontinued.

55. The three estates in question were those of Mr. Anwar Khyatt at Deltawa, Mr. Caramiciu at Beled Ruz, and Mr. Kouyoumdjan at Felujah. In order to give these estate owners the assistance they deserved it was decided to import from Egypt six cultivators trained in the commercial cultivation of cotton. Four of these were allotted to these three estates and the remaining two were employed in the Department. The cotton crop promised well on these estates early in the season, but on the outbreak of the disturbances cultivation had of necessity to be abandoned; irrigation was neglected, and the produce was pilfered by the rebels. Heavy financial losses were incurred on all three estates. This is especially unfortunate, as the enterprise and the enthusiasm of these estate owners deserved success.

56. The Egyptian cultivators together with the Agricultural Assistant in charge, Mr. Sabri Anwar, were repatriated towards the close of the cotton season. Mr. Anwar's task of keeping in touch with his cultivators scattered over the country, was a difficult one. I wish to express our gratefulness to the Ministry of Agriculture in Egypt for the valuable assistance rendered by him and his cultivators under very trying conditions.

#### C.—LOCUSTS.

57. The Locust menace in Mesopotamia is an annual one though the outbreaks vary in intensity each year. The distribution of the more destructive swarms is mostly confined to the steppe lands north of Hit and Samarra, and to the submontane tract, adjoining the Kurdistan and Persian Hills.

The particular variety which is most destructive is the Moroccan locust (*Dociotaurus Moroccanus*). Eggs are laid in the ground by the winged insects in May and June. The gravid females congregate in specially selected small plots of land to lay their eggs. Shortly after, the locusts die off. These eggs do not hatch out until the following March. The larva moults five times at periods varying from 7 to 10 days between successive moults. These locusts are most destructive to vegetation between the fourth moult and the time at which they are sexually mature—some 10 to 15 days after the final moult. They cease feeding shortly after they have mated.

Locusts are most vulnerable and easy to control from the time they emerge as larvæ from the eggs up to the third moult. At this latter stage they have attained a size at which they can cover the ground rapidly by jumping, and instead of being concentrated in isolated swarms they soon scatter in all directions over the country in search for food. As the natural vegetation of the steppe lands dries off with the increasing heat of summer, the locusts survive mostly on such cultivated crops as wheat and barley



which, at this season, are about ready to be harvested. The damage done to cultivated crops in years of severe attack (which, it is reported, average one in seven), is considerable. When the country was under Turkish Administration control measures were adopted but there is no record of success having attended their efforts. Cultivators normally destroy or divert advancing swarms in the hopper-stage by driving them into concentrated masses and then stamping them underfoot. Very occasionally shallow trenches are dug into which the hoppers are driven and then buried.

58. In 1920 five officers of the Agricultural Department, one from the Political Department, and one from the Revenue Department visited one of the centres where the swarms were reported to be in greatest numbers. This breeding tract lies on the Southern slopes of the Quiyara hills some 30 miles north of rail-head at Shergat off the Mosul Road. It is uncultivated and uninhabited except by wandering tribes. It was found impossible to collect sufficient labour to devastate the swarms. Various experiments were, however, conducted with the view to formulating a practicable scheme for the comprehensive control of all locust outbreaks. It is believed that in view of the scarcity of labour on these steppe lands, coupled the availability of oil for fuel within the country it is probable that the knapsack flare apparatus that has been used with success in certain countries may prove to be as economical a method of control as any of the methods normally undertaken.

59. Owing to the paucity of funds comprehensive control by Government Agency has temporarily been held in abeyance. Enquiries have been made in regard to the availability and cost of the necessary material; and it is hoped to undertake a preliminary campaign as soon as finances permit.

#### D.—FRUIT SURVEY.

##### (a) DATES.

60. The date crop is by far the most important fruit industry in the country. Mesopotamia is the home of the date and the major portion of the World's supply is grown here. Dates constitute the most important item of export at present. The average annual value of date exports is £2,000,000. The cultivation of dates is mainly confined to a narrow strip of land bordering both banks of the Shatt-el-Arab from the confluence of the Tigris and the Euphrates to the head of the Persian Gulf near Fao. The economics of the date industry has in the past received but scant attention; and there is a marked paucity of literature on this subject.

For a period of three months during the summer of 1919 Mr. (then Captain) V. H. W. Dowson was deputed to investigate the yield of date palms and of date gardens on the Shatt-el-Arab with the view to discovering, if possible, an equitable basis for the revenue assessment of date gardens. During this short period he collected much valuable information and a mass of statistics. Part of his report is now in the Press. During his investigations he weighed dates from 930 individual palms (representing 19 varieties) in representative gardens scattered between Basra and Fao. In 84 gardens the varieties of palms and other fruit trees grown and the frequency of each variety were recorded. By compounding these results the approximate yield of any garden may be ascertained if due consideration is given to the various factors which may influence the yield. The most important of these limiting factors are—age of the palms, availability and use of water, proper cultivation of the land, the density of the palms and of other fruit trees, and incidence of diseases and climate which vary from year to year. The problem, though a complex one, is evidently of sufficient importance to justify a continuation and an extension of this research into the economics of date cultivation when the opportunity permits.

61. Facts of special interest that transpired during this enquiry were (a) that the average number of bunches per palm varies from 6 to 11 with the variety;

- (b) that the average yield of inferior varieties (as in the case with many other crops) is considerably higher than that of the more prized varieties;
- (c) that the heaviest yielding palm is the Zehidi which gave an average of 126 lbs. of dates per palm;
- (d) that the five most common varieties are Istamram (45 per cent.) Halawi (32 per cent.), Khadrawi (8 per cent.), Dairi (4 per cent.), Zehedi (3 per cent.) other varieties (8 per cent.);
- (e) that the frequency of palm trees in the Basrah Sanjak compared with that of other fruit trees is approximately in the ratio 3: 1;
- (f) that the frequency of some of the more prized varieties is limited owing to the exorbitant price demanded for the off-shoots;



- (g) that the cultivation of the date palm on the Shatt-el-Arab is generally of a high standard. The palms are normally planted in such numbers as to give the optimum yield; the trees are tended with care and the ground thoroughly cultivated;
- (h) that date groves in full bearing are very profitable and capable of considerable extension;
- (i) that much could be done by way of advising and assisting land-owners in procuring those varieties of dates best suited and most profitable for their gardens.

#### (b) OTHER FRUIT CROPS.

62.—Mesopotamia grows a large selection of fruit, amongst which are included apricots, peaches, nectarines, grapes, figs, oranges, limes, lemons, citrons, apple, and mulberry. Of these, the citrus fruits (oranges, limes, lemons and citrons) can only be grown profitably in the shade of the date palm. It is a significant fact that despite the suitability of both the climate and soil of the country to most of these citrus fruits their extensive cultivation is only practised in one limited area. This area is mostly confined to the left bank of the River Diala for a distance of about 20 miles north of Baqubah in a zone varying in width from 1 to 3 miles. The agricultural practices and economics of the fruit industry in this tract are being investigated by Mr. C. Gauthby, Agricultural Circle Officer, Ba'qubah. His preliminary report, a short summary of which is reproduced in Appendix III is now ready for the Press.

63. Facts of special interest that have been revealed as a result of this survey are:—

- (a) that the citrus fruits are pre-eminently suited for cultivation on the banks of the Diala. (This is believed to be due to the high lime-content of the soil, and also of the river water);
- (b) that citrus fruits are normally grown in the shade of palm trees which protect the other fruit trees from the heat of the sun in summer and from mild frosts in winter;
- (c) that a well-managed orchard of date palms and citrus trees will, in a normal year, yield fruit to the gross value of about Rs. 3,600/- (equals about £225-) per acre; and that in a season of heavy crops and high prices, as in 1919, many orchards can yield more than double this amount;
- (d) that of the citrus fruits, sweet-oranges are the most profitable;
- (e) that the average yield of sweet-oranges in 1919 (a year of heavy yields) was 500 per tree;
- (f) that except for a good exotic variety of navel orange and of a thin-skinned lemon there would appear to be no necessity at present to improve upon the local varieties;
- (g) that there are great possibilities for extending citrus culture and of other fruit culture;
- (h) that the development of the trade in citrus fruits could be materially assisted to the advantage of the grower and the Government by establishing a fruit-experiment station in the Diala fruit belt.

#### E.—LIVE STOCK.

64. An enquiry into the economics of the sheep industry in Mesopotamia has been instituted by Mr. R. R. Anson, Agricultural Circle Officer, Mosul. Sheep rearing is an industry of primary importance to the country. There is at present no export of live stock or of mutton but a large trade exists between the steppe lands of Northern Arabia and the adjoining populated tracts of Mesopotamia, Syria and Palestine. Some half-dozen distinct breeds of sheep are recognisable. The majority of the flocks are of the fat-tail type. They live and fatten on the natural herbage of the desert and steppelands from the advent of the rains in December and January until about July and August when the pools of rain-water have been dried out and the vegetation is withered. The flocks are then brought in to the riverain tract or to the irrigated areas to be fed on wheat and barley straw until the next rains.

65. The subjoined statement gives the quantity and the value of wool exported by sea from Mesopotamia during the past 3 years. These figures have been obtained from the official Customs Circulars.

It is unfortunate that records are not available to show the quantity of wool exported each year. The value of the exported wool has decreased from Rs. 45½ lakhs in 1918 to Rs. 24 lakhs in 1919 and Rs. 8 lakhs in 1920. Two factors are believed mainly to have contributed to this heavy decline in

the value of wool exports. These factors are (a) the decline in the value of wool on the world's chief markets during the period 1918-1920; and (b). the fact that the figures for 1918 and to a less extent those of 1919 represent the value, in part, of stocks that had accumulated in the country during the Great War.

*Wool Exports, Mesopotamia.*

		EXPORTS BASRA.		EXPORTS BAGHDAD.		TOTAL.	
		Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
		Tons.	Rupees.	Tons.	Rupees.	Tons.	Rupees.
1918	...	?	45,52,432	?	?	?	45,52,432
1919	...	?	14,54,285	?	9,52,249	?	24,06,534
1920	...	745·3	7,71,579	24·7	45,137	770	8,16,716

F.—AGRICULTURAL MACHINERY.

(a) GENERAL REMARKS.

66. The shortage of agricultural labour in Mesopotamia is a subject constantly referred to in discussions and publications regarding the agricultural development of the country. It is believed that there is at present in the country enough agricultural labour to meet the demands of the existing irrigated areas with the crops now grown. In the event of summer crops, which demand intensive cultivation, being grown on a more extensive scale under these canals, then the demand for the available labour is likely to be in excess of the supply. In addition, the present available labour is not evenly distributed in conformity with the demands of the various cultivated tracts, and the shortage is already being felt locally. As increased areas are brought under cultivation with the opening of new canals a considerable shortage of labour is anticipated. History may repeat itself and Southern Arabia may again prove to be the breeding ground for Mesopotamian cultivators; but this will take time and measures should be adopted to avoid a labour crisis which appears to be imminent as a result of the conflicting demands of the Arab Army, the British Army, the Civil Administration, and Commercial Firms. Organised recruiting for all except the Arab Army should be obviated at all costs. The shortage of Agricultural labour is likely to be aggravated to a considerable degree on the Military Labour Directorate closing down, thereby necessitating the return to India of some 30,000 men now in the Indian Labour Corps and on the Railways.

67. In the meantime, efforts are being made to demonstrate to the landowners of the country various means of economising labour. The methods now in vogue in handling crops are as primitive as they were in the day of Abraham. There is considerable room for the utilisation of labour-saving Agricultural machinery. There is also, fortunately, the demand for that type of machinery which can demonstrate its usefulness under the very special conditions at present obtaining in the country. Amongst the machinery in greatest demand are included light-weight threshing machines, corn mowers, light-weight iron ploughs for bullock or mule draft, and plough tractors.

Thanks to the enterprise of various British Firms in the country samples of various types of this machinery have been imported and the work they are capable of doing has been demonstrated on the Government Experimental Farms.

(b) TRACTOR TRIALS.

68. It was contemplated to conduct early in the winter months a 30-day continuous ploughing test with the Tractors and ploughs then in the country. The actual tests were delayed until the opening of the current year. The duration of the Trials was eventually reduced to 14 working days. A report has been published by Mr. G. S. Cameron, M.C. Deputy Director of Agriculture, embodying the data collected for the separate outfits. The appended statement is extracted from his report.



*Statement giving summary of data recorded in Tractor Ploughing Trials,  
Baghdad, January, 1921.*

Name of Tractor.	Consumption Kerosine per acre.	Consumption Petrol per acre.	Consumption lubricant per acre.	Consumption water per hour.	COST OF PLOUGHING.			Area ploughed per hour.	of Quality work.
					Cost per acre.	Cost per donum.	Cost per Hectare.		
	Galls.	Galls.	Galls.	Galls.	Rs.	Rs.	Rs.	Acres.	
Fiat ...	3.9	10	18	not known	12.9	8.0	30.9	73	80%
Saunderson ...	4.0	05	15	12	12.4	7.7	29.7	63	88%
Austin ...	2.2	05	11	7	9.5	5.9	22.8	56	76%
Fordson ...	2.6	...	16	5	10.2	6.3	24.48	54	77%

69. It may be pointed out that the main object of these trials was to demonstrate to prospective purchasers the costs of running and the capabilities of the different outfits under local conditions. The Trials were in no sense competitive.

The all-in cost of ploughing per acre to a uniform depth of five to six inches varied between Rs. 9.5 and Rs. 12.9. This compares favourably with the native method of indifferent ploughing with the wooden plough which costs from Rs. 5/- to Rs. 10/- per acre.

A large number of landowners attended these trials; and provided facilities are at hand for obtaining spare parts and having repairs undertaken at short notice it seems very probable that tractors will be in great demand.

#### V.—MISCELLANEOUS.

##### (a) LIFT IRRIGATION AND FUEL SUPPLY FOR OIL ENGINES.

70. The narrow tract of land on the banks of both the Euphrates and the Tigris along the major portions of their respective courses through the alluvial plain of Mesopotamia is irrigable by direct lift from the river by artificial means. This statement may appear to be commonplace. Yet it is a remarkable fact that not five per cent. of this riverain tract is at present irrigated. The estimated area of this irrigable tract is half a million acres. Lift irrigation by oil-engines and pumps is known to be economical compared with lift by animal power. Various factors have militated against the extension of lift irrigation by pumps. Amongst these factors may be included the initial capital expenditure involved; the absence of security of tenure and of protection to property; the high cost of transport of agricultural produce; and, lastly, the long distances which liquid fuel has to be transported at the expense of the cultivator coupled with the difficulty of procuring a regular supply.

In regard to the capital cost incurred, the agents for various engines and pumps offer easy terms by which part payment may be made at harvest of the first crop. With the quelling of the Nationalist Revolt of 1920 reasonable security to life and property has again been restored. The problem of security of tenure of land can only be satisfactorily settled on an organic law being established. The question of fuel supply demands separate consideration.

71. The sole suppliers of Kerosine and fuel oil in Mesopotamia are Messrs. Strick-Scott and Co., Ltd., Agents for the Anglo-Persian Oil Company. The sale price for these oils have until recently been quoted as follows:—

Kerosine	...	{ Palm Tree Brand	...	Rs. 1 6 0	per gallon.
		{ "Qualyan" Brand	...	Rs. 0 14 0	"
Fuel Oil	...	(More commonly known as crude oil)	...	Rs. 0 11 6	per gallon ex-tank.

Very recently the price of fuel oil ex-tank in bulk has been reduced to 10 annas per gallon. Except when supplies are exhausted in the various depots scattered over the country, the Palm Tree brand is not used as fuel for oil engines. The reason for the marked difference in the prices of the two brands of Kerosine is the fact that during the War it was decided to supply the native population with their kerosine requirements at cost price

in order to encourage the production of cereals under lift irrigation. This concession still obtains, and the rate quoted for "Qualyan" brand is a flat rate for the whole country. The recent reduction in the price of Fuel oil is a step in the right direction. But when it is realised that Mesopotamia possesses such large potential supplies of oil it does, at first hand, seem paradoxical that "fuel oil" could not be supplied to the native population at a lower price than 10 annas per gallon. In this connection it is well to remember however that the kerosine and fuel oil at present marketed in Mesopotamia are virtually obtained from foreign territory namely Persia. And not until the sources of supply, known to exist in the country, are tapped, will it be possible to plead, in the interests of the Agricultural development of the country, for all oil fuels to be supplied to the native population at cost price.

In fairness to the agents for the Anglo-Persian Oil Company we wish to record the fact that they have, throughout, given most sympathetic consideration to all matters in which they have been approached. They now have in view the establishment of depots for kerosine and fuel oil in new centres in response to the increasing demand from agriculturists. This question of oil supply for lift irrigation is one of paramount importance to a country where the extension of cultivation on land that can be watered by pumps offers such considerable scope.

#### (b) LAND DEVELOPMENT SCHEMES.

72. During the year numerous applications have been received from landowners for advice in opening up their estates. Most of these estates are in the riverain tract, and are irrigable direct from the river by pump. The recent slump in trade has given a decided impetus to estate development as the result of numerous financial failures amongst the native population engaged in commerce. It is being realised that investment in irrigable land in Mesopotamia is a safe security though it may not always bring in its 100 per cent. dividend.

A noticeable feature of most of the estates now being brought under cultivation for the first time is that very little, if any, attention is paid to the gradient of the land. The necessity for preliminary contour surveys is not realised and in consequence much money is wasted in endeavouring to take water up-hill. The Agricultural Department can give but little assistance in this matter until an Agricultural Engineer has been appointed.

73. An interesting and important experiment in estate development is that now being undertaken near Mosul through the enterprise of Lt. Colonel J. M. Birch, D.S.O., Managing Director of the Mosul Farms Company, Ltd. This Company, which has a capital of Rs. 300,000 is comprised of a number of owners of large estates of unirrigated land capable of raising good crops of cereals. The main object of the Company is to develop land, at present uncultivated, by means of labour-saving machinery. Should this attempt be a commercial success there is every probability that other landowners will co-operate with the same object in view. It is in these unirrigated tracts capable of raising cereal crops that the labour shortage is most pronounced.

#### VI.—PERSONAL.

74. The compilation of this report has devolved upon the undersigned, but any merit that may be claimed for the work accomplished during the year must be credited to Dr. Graham during whose absence on leave the report was written. It was mostly in virtue of his sympathetic guidance and direction in the work undertaken by the various officials concerned that it has been possible to report progress.

It is, perhaps, invidious to make distinction where practically every officer in the Department set and maintained a high standard of efficiency. Special note may, however, be called to the successful manner in which Mr. G. S. Cameron has co-operated with the various agents for agricultural machinery in importing and demonstrating the use of labour-saving machinery; to the valuable results of the soil surveys undertaken by Mr. J. F. Webster; to the investigations of Mr. C. Gauthy into the economics of the fruit industry in the Diala tract, and of Mr. V. H. W. Dowson into the economics of date cultivation.

I wish to place on record my appreciation of the sympathetic manner and the readiness with which several commercial firms have co-operated with the officers of the Agricultural Department in various matters concerned with the Agricultural development of Mesopotamia.

Political Officers have evinced keenness to learn and constant readiness to assist. In this connection I wish to acknowledge the very material assistance afforded by Lt.-Colonel L. J. Nalder, C.B.E., C.I.E. (Divisional



Adviser, Mosul) Major L. M. Yetts, M.C., (Divisional Adviser, Ramadi) and Captain J. O'Sullivan (formerly Assistant Political Officer, Museyib).

To Lt.-Col. Dent, D.S.O., Intelligence Branch G.H.Q., we owe our thanks for the sympathetic manner in which he co-operated with us at a very critical period in the history of cotton cultivation in Mesopotamia.

We owe a debt of gratitude to the British Cotton Growing Association for the promptitude with which they met our wishes in importing and erecting ginning plant ready to receive the 1920 crop of cotton. Their representatives in Mesopotamia:—Messrs. A. Eastwood & F. Feber have been most helpful.

Amongst subordinates the work of Mr. Ahmed Ali Soofi at the Cotton Farm, Karradah, of Mr. Ghulam Hussain at the Tel Deir Cotton Estate and of Mr. Akbar Ali, Head Clerk, Directorate Office, has been of outstanding merit. It is pleasing to be able to record that Mr. Soofi was honoured with the title of "Khan Saheb" in the New Year's Honours List.

In conclusion, I am glad to have this opportunity of recording the invaluable assistance I have received from Mr. H. G. D. Roorke, Personal Assistant, without whom it would have been practically impossible for me to officiate as Director of Agriculture in addition to my duties as Cotton Expert.

ROGER THOMAS,  
*Offg. Director of Agriculture,  
Mesopotamia.*

*25th May, 1921.*

## APPENDIX I.

## Administration Report of Deputy Director of Agriculture.

In forwarding the Annual Reports of the Circle Officers of the Department of Agriculture I regret to have to state that their perusal is not very inspiring. In different forms they all repeat the same tale, a tale of persistent endeavour, and little achieved. That such should turn out to be the case was fairly obvious towards the middle of last year when the whole country was in the state of unrest which eventually led up to the outbreak of rebellion. Previously however the condition of affairs which ultimately resulted was not anticipated, and the year was begun with enthusiasm which carried us through the latter end of the Winter, and early part of the spring seasons which is the most trying time of year for officials of the Department. Commencing with the locust campaign in the middle of April all Circle Officers were summoned to Mosul to take part in an organised effort to combat the huge swarms of hatching-out locusts.

The campaign lasted from April 17th to April 27th during which time much energy was spent in endeavouring to check the onward advance of the locusts which were on the move from the in-lying desert towards the growing winter cereals.

The number of people available, and the limited means at their disposal was hopelessly inadequate for the undertaking. Nevertheless a determined effort was made to destroy as many locusts as possible. The conditions which prevailed throughout the campaign were very disheartening. Severe climatic conditions were experienced, and the indifference of such Arabs as were available added further to the difficulties at the time.

Whatever the results of the campaign it demonstrated clearly the necessity of a very highly organised and well equipped staff to be able to deal with this pest effectively.

Immediately the locust campaign terminated all Agricultural Officers had to proceed immediately to their respective areas to prepare for the wheat and barley harvest, particularly with regard to the taking of metre samples. These were carried out in the following areas.

Feluja.....	By Lt.-Col. R. J. D. Graham.
Diwaniyah.....	„ Lt.-Col. J. M. Birch, D.S.O.
Baghdad .....	„ G. S. Cameron, Esqr., M.C.
Hindiyah.....	„ H. V. W. Dowson, Esqr.
Hai.....	„ W. D. Garbutt, Esqr.
Ba'qubah.....	„ C. Gautby, Esqr.
Khaniqin .....	„ „
Sulimani .....	„ „
Mosul .....	„ R. R. Anson, Esqr.
Erbil.....	„ „

In all 2,361 samples were taken. These were despatched to Baghdad where they were carefully threshed and weighed. The weighing of the threshed samples was carried out by Mr. C. L. White.

### *Testing Stations.*

*Sherghat.* In consultation with the Director of Agriculture and the Agricultural Officer Mosul, it was decided that it would be more advantageous to carry out cotton varietal tests at Sherghat instead of Mosul. The main reason which led up to the above decision was the difficulty of obtaining a suitable site in Mosul. The only one available was dependent on a well for irrigation water and it was questionable if this supply was adequate for the requirements without installing a very expensive means of delivering the water. Sherghat being at railhead was an additional advantage, both from the point of view of being within easier reach of Baghdad for purposes of inspection, and delivery of seed, implements, etc.

The site selected by the Agricultural Officer apart from its requiring a considerable amount of levelling was an ideal one.



The soil was of a texture which secured a very high percentage germination subsequently.

The very hard work of opening up this new station fell to the lot of Mr. Anson who persevered in his efforts despite some very discouraging mishaps notably the collapse of his first "Cherid" owing to part of the river bank being washed away in one night by a rapid rise in the river. Labour difficulties were also encountered, but successfully overcome.

A high germination which was particularly even, promised well for the results which would be obtained from this Station. Fate however decreed otherwise, and it was just when the plants were a few inches high that an attack of locusts threatened and ultimately destroyed the crop.

Desperate efforts were made to ward off the locusts, but they were too overwhelming. In a few hours they cleared every plant, leaf and stem.

It was disheartening to have to acknowledge defeat at the very outset particularly so in this instance where such high hopes were originally entertained. There was nothing for it however but to close down the station immediately and avoid waste of time and money in an endeavour to keep it going.

A similar fate befell the special cotton selections which were being propagated for the Department, by one of the Mosul cultivators who had had previous experience of cotton growing in Egypt.

These experiences at Sherghat and Mosul emphasise the risk of early sowings in this particular part of the country, where there is the ever recurring danger of locust invasion from the inaccessible breeding grounds in the desert to the West of Mosul.

*Kut.*—The Headquarters of the Lower Tigris Circle were transferred from Amara to Kut with the intention of placing the Agricultural Officer in a better position to become acquainted with the districts on the Shatt-el-Hai. It was not intended originally to open a testing station at Kut until the Autumn as the land is not irrigable by flow.

The Agricultural Officer was very anxious to try and run a series of cotton varietal tests however even though he anticipated some trouble in irrigating by charid.

These difficulties materialised in due course and the cotton had to be abandoned. The experience gained however was very useful in that it afforded good preliminary training for the fellaheen who previously were quite unacquainted with cotton cultivation.

After the erection of the oil engine and pump there was an unfortunate break down which seriously affected the Bersim, Date-of-sowing test.

It is satisfactory to note that the pumping set eventually gave satisfaction and has continued doing so since.

Since the water supply has been guaranteed, the station has come on remarkably well and valuable results are expected from the series of experiments which are now being conducted with winter and summer crops.

It has been stated that the site of the Testing Station at Kut is not a very desirable one on account of its being somewhat uneven. This fact was fully realised when the site was selected but as it was the only one available, there was no choice in the matter.

This station affords an opportunity for interested cultivators to see imported types of wheat grown alongside of the varieties indigenous to the locality.

So far there has been little, if any, cotton cultivation in the Kut area, but several large landowners have expressed a desire to give it a trial. Two of them have already sent some of their fellaheen to live on the station with a view to learning its cultivation and treatment, and others propose doing so. It is very gratifying when such instances occur for they go to show that the Arab takes a real interest in, and, it is hoped, will himself adopt better methods of cultivation.

This station should also considerably assist in the production of supplies of pure seed.

*Museyib and Hilla Testing Stations.* The Hilla Testing Station which was started in 1919, and the Museyib station in 1920 were both doing extremely well until the outbreak of the rebellion. The Hilla station had to be abandoned as it was outside the defended area and suffered occasional shell fire from our own artillery.

The Museyib station became inaccessible after the town had to be evacuated since when it has not been possible to reopen it. This is much to be regretted, but as no officer is available there is no alternative in the meantime.

*Baquba Testing Station.* Between August 12th and September 1st while Baquba was in the hands of the insurgents the Testing Station was looted and the whole of the experimental work done in the hot weather

rendered valueless. Had it not been for the rebellion the results obtained from this station would have been very valuable, as a particularly uniform growth had been secured. Even more disheartening is the loss of the Agricultural Officer's fruit survey records which were the results of months of careful observation.

Work was recommenced on this station and experiments are now in progress with imported varieties of wheat and date of sowing experiments with bersim.

During the hot weather of 1921 the Agricultural Officer proposes to continue his investigation into the economics of the fruit industry. His idea of opening stations at Kirkuk, Khaniquin and Sulmani and the work proposed on each is sound, but the question of personnel and finances will make this impossible for some considerable time.

#### *Rustam. Government Farm and Experimental Station.*

This Station was actually started in April, but it was a very long time before it showed signs of progress. This was only to be expected as the site is over ten miles from Baghdad and there was considerable difficulty experienced in conveying material, and labour was next to impossible to obtain.

The original plan was to put down a small pumping plant to irrigate sufficient land for green fodder for the plough animals.

There was considerable difficulty however in getting the pumping outfit to run satisfactorily. This was not accomplished until about eight months afterwards. In the interval it was necessary to purchase grain and fodder locally at a time when the former was very expensive, and the latter proportionally more so.

Two 30 H.P. pumping outfits were ordered, and delivery promised by October. In the meantime the Engineer at Rustum made a map of the farm and laid out his canals in order to secure the best command of the land.

Work on temporary buildings was commenced, and plans of the general lay out of permanent buildings were made.

As a considerable amount of erosion of the right bank of the Diala takes place at Rustum, it was necessary to safeguard the pumping outfits by sinking a well at some distance inland.

The work was started in August, simultaneously with the sinking of the well 120 feet inland, a coffer dam was built in the Diala to allow of the construction of the intake chamber and the pipe connecting it with the well.

These were designed to take water at the rate of 10,000 gallons per minute.

The sloping roof of the intake chamber was so designed as to cause the current to "swirl" at the downstream entrance to the chamber thus preventing silt depositing and choking the entrance.

It would have been better if the well had been left alone, and work concentrated only on the intake chamber, and the pipe leading from it.

At the time the work was initiated the labour problem was acute, owing to the disturbed state of the country. Fear of attack from hostile raiding parties made it next to impossible to secure labour to work on the construction. Advantage had to be taken of the low condition of the river to try and get the work completed, but this very condition hindered the navigation of the barges carrying sand and cement for the construction of the well. In consequence the well was not completed before the expected rise in the river and though every effort was made to carry on, it became clear towards the end of the year that the well could not be completed until the return of the low water season. It will be used as it stands provisionally, but it may be necessary to arrange for extra piping to connect the pumps direct with the river until the well is completed. This extra amount of piping will eventually be required for other pumping outfits as the area at Rustum is extended.

Until the nonsilting, intake chamber has been in operation for a complete year it will not be possible to say whether its use is to be recommended or not. If however the idea proves to be as sound as it appears it should be very beneficial as much trouble is experienced in keeping wells clear of silt in the low water season. Experience has taught the necessity of completing the intake chamber, and connecting pipe independently from the construction of the inland well.

The Department of Agriculture should take care to impress this on any who may take up this particular type of well construction in the future.

General work on the farm was resumed in real earnest from the middle of October.



It was impossible to irrigate the land before ploughing owing to lack of pumps, so ploughing operations had to be commenced under very trying circumstances.

The intention was to break up as much land as possible in anticipation of pumps arriving in time to irrigate winter crops. As the pumps did not materialize in time it was decided to sow a quantity of wheat and barley, and endeavour to grow them under daim conditions.

It was hoped that water would be available in time to give one irrigation to these areas, but this has not been realised and the rain fall this year has not been sufficient to rear the crops thus sown.

The temporary pumping outfit will probably suffice to irrigate the following areas which were sown with the intention of obtaining pure seed supplies of the undernoted varieties of wheat:—

8 acres of	A 113
28    „    „	Punjab 11
35    „    „	Punjab 15
2    „    „	B 8
2    „    „	A 8
2    „    „	Cross 3.

In addition it will be required to irrigate varietal test plots of these same wheats, about ten acres of barley, a small area of lucerne and the tree nursery.

The prospect of having water to irrigate the cotton crops appeared somewhat remote, as the two large pumping outfits which were expected in October, 1920 only arrived in March, 1921.

In anticipation of their arrival however land was ploughed, ridged and plotted for the experimental work on the research block, and about two hundred acres prepared on the estate for growing cotton on a commercial scale as the source of the 1922 seed supply of "Mesopotamia White." This is the cotton which has been selected as being the best all round variety for Mesopotamia.

#### ARBORICULTURE.

The attempt to start a tree nursery at Rustum in the spring did not succeed owing to the lack of water after the failure of the temporary pump. Such being the case it is fortunate that it had been decided to continue with the original tree nursery which adjoins the Military Dairy Farm.

In July 1920 Mr. Glenister went on leave. The question of carrying on the nursery would have been a difficult matter owing to lack of someone to supervise the work. Mr. Rooké however volunteered to do this in addition to his other duties.

A large number of young trees have been transplanted along the canal banks of the Central Farm at Rustum. There has been a steady demand for young trees and seedlings from various departments.

These have mostly been for shrubs suitable for making hedges. For this purpose *Dodonea* appears to do best in this country, but it should be **grown from seed *in situ*** as it does not do well when transplanted.

For shade and ornamental purposes it will be hard to beat the Indian Weeping Willow imported from Quetta.

These are being propagated from cuttings and it is hoped to have a large number for transplanting in the autumn of the year.

For quick results the rapid growing *Sesbania Aegyptica* is to be recommended. This however does not withstand the Mesopotamian winter.

A large consignment of seed of *Dalbergia Sissoo* arrived from India. This is likely to prove a useful tree for this country. The seed has been issued in large quantities to Circle Officers.

If all goes well, it should be possible to fully meet the needs of all departments wishing to purchase seedlings this year. Before making any issues however it is necessary to ensure that indenting parties have an efficient water supply for irrigating the trees and shrubs after they have been transplanted.

It would also be advisable to impress on all who intend growing trees the need for continued care and attention after transplanting. Cases have occurred where young trees have been put into gardens which after a time have passed into the hands of others who have not continued to take an interest in the plants.

This is to be regretted as the stock of suitable shrubs is still limited, and what there is is the outcome of much care and attention to raise stocks which will probably suit a country with such climatic extremes as Mesopotamia.

*1920 Metre Tests for estimating the yields of wheat and barley obtainable throughout the country.*

In order to collect figures relating to the yields of wheat and barley in Mesopotamia, as many officers as possible were asked to undertake the estimating of wheat and barley crops by means of the metre-square method which the Department initiated in 1919.

Metre cuttings of first, second, and third class barley and wheat were taken. The ears were dried, threshed, and accurately weighed. The results of these weighments are given in the following which show the 1st, 2nd and 3rd class yields obtained expressed in kilos per donum as computed from square metre cuttings.

*Table showing average of metre cuttings taken in different districts throughout Mesopotamia.*

BARLEY.

		1st Class.	2nd Class.	3rd Class.
Daudiyah	...	532	376	125
Tarmiyah	...	530	316	226
Aqar Guf	...	873	369	253
Nasiriyah	...	772	457	208
Kut	...	501	311	159
Dewaniyah	...	577	323	174
Felluja	...	1,025	785	229
Mosul	...	738	...	222
Tel Afar	...	580	...	...
Sherghat	...	677	...	...
Arbil	...	...	327	...
Sahaji	...	432	229	...
Diyalah	...	621	615	...
Kirkuk	...	433	313	126
Sulaimani	...	646	437	...
Hindiyah	...	541	255	113
Average	...	632	378	183 Kilos per donum.
		2,224	1,329	643 lbs. per acre.

WHEAT.

Nasiriyah	...	857	518	201
Kut	...	510	332	213
Dewaniyah	...	485	366	125
Felluja	...	754	424	158
Mosul	...	470	252	126
Tel Afar	...	...	158	91
Sherghat	...	...	167	85
Arbil	...	359	...	...
Sahaji	...	...	323	...
Diyala	...	460	247	...
Kirkuk	...	...	271	143
Sulaimani	...	...	261	170
Hindiyah	...	521	262	133
		4,416	3,581	1,445
Average	...	552	298	144 Kilos per donum.
Average	...	1,942	1,048	505 lbs. per acre.

IMPLEMENTS AND MACHINERY.

The year has been an eventful one in that it marks the beginning of a new era in the Agriculture of Mesopotamia.

To do away with expensive and inefficient labour in certain agricultural operations the introduction of modern machinery is essential.



Prior to the war, there were a few harvesting machines brought into the country, but before their utility was established, the war broke out, and nothing further was done until the year 1919 when several firms in Mesopotamia introduced agricultural implements of various types.

Some have been introduced as a speculation, and others on the recommendation of this Department.

Early in the year a tractor ploughing outfit was brought to our notice and given a fair trial, at the end of which the importing agents were frankly advised not to import any more of this particular type, as it was not considered a sound proposition for the country.

By the end of the year there were four types of tractors, and one motor plough in the country, and it was decided in co-operation with the agents to give them a fourteen day trial at the Government Central Farm Rustum. The details of the trials are embodied in a printed report issued by this Department in March. The trials afforded facilities for the collection of valuable information relative to speed and cost of ploughing per acre. The latter, on an average, worked out at about fourteen shillings per acre, taking into account depreciation on the machines at twenty per cent. per annum. This figure is given in sterling in order to compare it with the contract rate for ploughing by tractor in the United Kingdom which, at the present time, is thirty-four shillings per acre.

This merely refers to ploughing. It is hoped to have more figures this coming Spring, showing the costs of harvesting per acre, and threshing per ton.

Considering the cost of labour during the harvest when men demand from five to ten rupees per day, there should be little doubt as to the result of comparing the costs of harvesting by machinery with the old fashioned methods which involve the use of the sickle.

That there is a future for tractors, and other modern machinery in this country there can be no doubt.

The present high rate of exchanges and trade depression generally will have an adverse effect for some time to come, but ultimately modern, up-to-date methods are sure to replace the present practices.

There has been a fair number of reapers introduced in the last year, but it is too early as yet to state definitely how they will take on.

Two self binders have been imported, and their performances will be watched with interest.

They may save a considerable amount in labour, but the cost of binder twine at present appears to be prohibitive. Also there is likely to be a considerable loss of grain through shedding when crops have to be harvested dead ripe.

Three types of threshing machines have been imported. One of these is of the smaller type, and will be used on the Government Farm at Rustum and in addition will be hired out to local cultivators should there be any demand for it.

#### LAND DEVELOPMENT SCHEME.

Several land development schemes have been mooted, but so far little has actually been done.

One such scheme has got well under way near Basra. The promoters however appear to have followed a short-sighted policy in neglecting to have a survey made of their land. They are thus prevented from laying out their canals to full advantage.

They also appear to have overlooked the necessity of draining the land which practice if neglected will lead to excessive salinity as the water table is very high.

The promoters were cautioned in the matter, but so far they have retained their own methods.

#### MOSUL FARMS, LTD.

One of the most interesting events of the year, in the Agricultural World of Mesopotamia, has been the foundation of an Arab Farming Company under the direction of Lt.-Col. J. M. Birch, D.S.O.

The progress of this concern will be watched with interest by many. It will be some considerable time before the company can get down to actual cultivation as the machinery has yet to be imported. There will be considerable difficulty in getting the large outfits on to the actual scene of operation. Once this is accomplished the concern should go well. The initiative and enterprise shown should receive every encouragement from Government and other sources for concerns of this type will do much to foster the prosperity of the country.

## CONCLUSION.

The year has been a particularly trying one, and it still remains so as the future is so uncertain.

The necessity of retaining the services of our officers and subordinate staff cannot be over emphasised. One and all have persevered under most discouraging conditions, but it is difficult to say how long they can be expected to do so.

Should any of our staff go on completion of contract they would be a real loss to the Department and to the country. It is to be most sincerely hoped that before long there will be no need to have such fears.

G. S. CAMERON,  
D. D. A.,

*14th April, 1921.*





## APPENDIX II.

## Administration Report of the Deputy Director of Agriculture (Research).

## STAFF.

At the commencement of the Calendar Year the staff of the Research Section of the Agricultural Directorate was as follows:—

*Deputy Director of Research and Cotton Expert:*

MR. R. THOMAS, B.Sc.

*Agricultural Chemist:*

MR. J. F. WEBSTER, B.A.

*Agricultural Entomologist:*

MR. C. R. WIMSHURST, B.Sc.

*Assistant Chemist:*

MR. B. VISWANATH, F.C.S.

*Assistant Entomologist:*

RAO SAHEB Y. RAMACHANDRA RAO, M.A., F.E.S.

*Assistant Mycologist:*

MR. S. R. VENKATA KRISHNA MUDALIAR, B.A.

*Assistant Botanist:*

MR. H. P. PARANJPYE, B.A.

Mr. Wimshurst left the Department on 15th May 1920, on completion of contract and since then the post of Entomologist has been vacant. On 27th July 1920, Colonel R. J. D. Graham, Director of Agriculture, proceeded on leave to England. Mr. Thomas assumed charge as officiating Director of Agriculture in addition to his duties as Cotton Expert, and Mr. Webster took charge as officiating Deputy Director of Research. The Assistant Chemist Mr. Viswanath proceeded on deputation to India in the beginning of the year for the purpose of making purchase of laboratory necessities, such as were not available in the country, and returned in the beginning of May 1920.

The services of all the Scientific Assistants were kindly lent by the Government of India. All were on a one year's contract only, which expired in November 1920, and all were desirous of returning to their permanent services in India.

Accordingly Rao Saheb Y. Ramachandra Rao and Mr. Vishwanath left in December, and Mr. Mudaliar in the end of November 1920, Mr. Paranjpye, however, expressed his willingness to remain until relieved and continued to work throughout the year.

Our thanks are due to the Government of India for the loan of the services of these men which have been of the greatest value in the work of the past year.

## OFFICE STAFF.

From February 1920, when he relieved Mr. H. Athaide, Mr. Mukand Lal has been in charge of the office as Head Clerk and Accountant to the Research Section and Head Clerk and Accountant to the Cotton Expert. This clerk also undertook the duties of Accountant for the Tel Deir Cotton Estate. Mr. P. Peters was Typist for the Research Section and the Cotton Expert, and Mr. Doraiswamy did duty as records clerk for the combined offices throughout the year.



## LABORATORIES.

At the beginning of the year work was in progress with a view to altering the two lower rooms of one billet, and adding two additional rooms so as to enable them to be used as laboratories. This work was completed in February and it was not until then that consecutive laboratory work could be carried out. There are at present therefore four small rooms which are used as laboratories, and for the major portion of the year there were five people actually working in these temporary laboratories. Naturally there was considerable over-crowding and this has become increasingly felt throughout the year, as specimens, literature, apparatus and materials have gradually accumulated.

The present accommodation was never intended to be other than temporary, pending the erection of a Research Institute, but this from various causes has been delayed.

It will probably be found necessary to increase the accommodation if the new Scientific Assistants, who are expected early in 1921, are to do satisfactory work.

## APPARATUS AND CHEMICALS.

The original stock of these which was on hand at the beginning of the year consisted of that of one Water Filtration Unit. This of course was inadequate for the needs of all Sections, and indents were made and sent to England. Most of this material arrived in due course but even at the end of the year a certain amount was still to come. Mr. Viswanath also purchased a large amount of essential material during his deputation in India and it is chiefly by reason of this that the staff has been enabled to carry on.

It has been realised all along that the accommodation and general conditions of work were not such as to allow of refined work, and when the move to a larger and properly fitted laboratory takes place a great amount of further apparatus will be necessary.

## BOOKS AND LITERATURE.

During the year a large number of text books for use in all four sections were ordered and of these a number have arrived. The Research Section also subscribe for a number of Agricultural Scientific Journals and these have arrived during the year. The need for a library in which to accommodate books, and more particularly these journals, is become increasingly felt.

## TRANSPORT.

The need for transport for all officers was met during the year by provision of two Ford Vans for the entire section. These have only reported for duty very irregularly throughout the year and towards the latter end of the year not at all. Apart from the ordinary daily necessity for some sort of transport, it is essential in the interest of the work that all officers should be able to tour when necessary, and the limited transport facilities throughout the country make it imperative for such officers to have independent transport when on tour. The arrangements of the past year cannot be regarded as satisfactory, and have been a constant handicap in all Sections.

## BOTANICAL SECTION.

Throughout the year the Assistant Botanist has devoted his attention primarily to the collection and mounting of specimens of the Flora of Iraq. Hand in hand with other work this has been continued throughout, and a collection of about 400 species of different genera has been made. Many of these have been identified and one set so far as was available up to July last was sent to Kew for identification. A further set completed up to the end of the year is being taken by the Assistant Botanist to Poona for identification. These two sets when they are returned, named, will form a nucleus for a herbarium, and if properly mounted and poisoned will prove valuable for future reference.

Owing to lack of transport facilities the collection so far can only be said to be representative of the Baghdad Area, though visits have also been made to Hillah, Baqubah and Mosul and many specimens obtained from these localities. Routine identifications and germination tests were made as required throughout the year.

During the Grape season the culture of the Grape Vines at Baqubah was studied. The results were embodied in a paper, "Grape Cultivation at Baqubah." Nine main varieties of grapes were noted, and two very distinct methods of cultivation described. The comparative freedom from pests, both insect and fungoid, which is enjoyed by the crop, in spite of the lack of all precautionary methods, is noteworthy. Attention is also called to the crude methods of packing and marketing of what is in many cases a fine and valuable product.

Throughout the year attention was also given systematically to the Culture of vegetables in the Baghdad Area. The peninsula of which Karadah forms a part may be regarded as almost the market garden area of Baghdad, and after a year's study of the operations on this area a paper was written on "Vegetable Cultivation in the Neighbourhood of Baghdad." The subject is treated under the three heads of Summer, Winter and River-bed Cultivation and each crop is treated separately.

During the early part of the year the Citrus Gardens of Baqubah were visited and a Note on their cultivation prepared. The methods of propagation and subsequent treatment are described, and again, as in the grape gardens, the absence of any serious pest or disease is noteworthy. Other notes which have been prepared by the Botanical Section during the year are: —

- (1) Note on *Orobanchë Ramosa* (L.) the parasite plant known to the Arab as "Kalya."
- (2) The Arabic names of Plants in Iraq.
- (3) Molasses or "Debes."
- (4) Fig Cultivation.
- (5) Cultivation of Mulberry.
- (6) A list of Plants of Iraq.

During the early part of the year Mr. Wimshurst was in-charge of the wheat work. All the types of wheat and barley in Iraq were collected so far as might be and these were grown and studied during the season 1919-1920.

A "Note on the Wheats and Barleys of Mesopotamia" was published by Mr. Wimshurst during the year. In addition a number of varieties of English and Australian Wheats received from the Plant Breeding Station, Cambridge University were grown. All these types together with additional ones from England, Australia and India are being grown experimentally at the Rustam Experimental Station this year, for purposes of further study. The main desirable features, for the irrigated lands of Mesopotamia are rust resistance and early maturity, whilst it is hoped that some of the drought resisting varieties of Australia may prove valuable on "Daim" areas.

## CHEMISTRY.

Work in this Section cannot be said to have commenced in earnest until May when the Assistant Chemist returned from leave bringing with him a large amount of essential apparatus and chemicals. Since that time however the work has progressed uniformly. A certain amount of routine work has been done and analyses have comprised:—

- 12 soil samples.
- 8 samples of Ground Nut.
- 4 samples of Linseed.
- 6 samples of Water.
- 1 sample of Concrete.
- 2 samples of Sugar Cane

Apart from this routine work two main subjects have been investigated throughout the year. The first is the salt problem. The findings of the preliminary enquiry are summed up in a paper on "Alkali Lands of Iraq," which is being published. It is found that there are large tracts of land in Iraq which are already suffering from alkalinity and still larger tracts which are becoming dangerously salt. The main source of the salts is undoubtedly the river waters, which often contain as much as 100 parts per 100,000 of water soluble matter. The most dangerous aspect of the problem is the occurrence of seepage from both rivers and canals almost universally in all parts of the country. The most commonly occurring salts are the sulphates and chlorides of Sodium, Magnesium and Calcium. Throughout the course of the enquiry no "Black Alkali," (Sodium Carbonate) was noted.

Owing to the high salt content of the waters used for irrigation, the low rainfall, and the total absence of drainage throughout the country irrigation itself however scientifically done means a gradual accumulation of salts, and it is obvious that some form of artificial drainage must be



established. The tidal irrigation system in the date gardens around Basrah is also discussed, and the way in which the canals are able to act both as irrigation canals and drains owing to the tidal rise and fall is illustrated.

Finally it is suggested that, owing to the fact that over large areas there is no subsoil water system near enough to the surface to affect the problem, something might be done in the way of washing down salts.

It is unfortunate that owing to recent disturbances the field experiments which it was hoped would be carried out on some of the Salty lands in the Hillah area had to be abandoned.

Secondly a start has been made on a Systematic Soil Survey of the country. One area has been completed, and the results of this enquiry are being published under the title of "A Soil Survey of the Diahlah Area (Right Bank). The area is all of the alluvial loam type common to the whole country. The soil's most urgent need is for increased organic matter and nitrogen. This can probably best be met by green manuring. Thirty-three soils were completely analysed in the course of this enquiry, and a number of miscellaneous analyses were also made. The need for some system of drainage is most apparent when the distribution of soluble salt is compared with the Contour Map of the area.

In the progress of the chemical work generally it became apparent that the method of mechanical analysis employed was giving results for clay which were surprisingly low.

An enquiry was started into the methods. Dr. Beam working in Egypt had found the same to be the case with some of the soils of that country. He elaborated a method using weak solutions of Sodium Carbonate to ensure his clay remaining in suspension for the specified period.

The method was investigated together with most other recognised methods. Finally for reasons which may be found in a paper: "*The Mechanical Analysis of Soils of the Arid and Semi-Arid Regions with special Reference to Mesopotamia*" the method of separation by sieves and further by sedimentation in distilled water was adopted for use in these laboratories. Further work has been done on the Physical aspect of the Salt Problem, the tolerance of salt by plants, and the physiological influence of salts on plant growth. It is expected that the results of the work will be published early in the New Year.

## ENTOMOLOGY.

The Entomological work throughout the year has been chiefly the collection and mounting, and, so far as might be, the identification of the insects of economic importance in this country. Owing to the fact that the Assistant Entomologist brought with him a named series of South Indian economic insects a great many identifications, have been possible, but all the insects so far collected and mounted have been given serial numbers and sent to various authorities for identification. It is possible that many of these are new species. The silk worm eggs which were retained in the laboratory for observation purposes were under the charge of the Assistant Entomologist. All types were hatched and fed, and samples of the adult insect were bred and preserved the remaining cocoons being stifled. Fumigation of seed particularly of cotton seed was also undertaken by the Entomological Section.

During the Spring of the year a great many notices were received of the attacks of locust. One outbreak reported as particularly severe was that in the Mosul Area in the district between Jirin and the Tigris North of Shergat.

In the absence of the Government Entomologist the Deputy Director of Research took charge of operations against the pest and was assisted by the Deputy Director of Agriculture and four Circle Officers together with a Political Officer and a Revenue Representative. The locusts were already in their third moult when operations were commenced, and time therefore was a great factor. The methods of control used and a general account of the outbreak may be found in the Deputy Director of Research's "Report on the locust outbreak 1920."

Spraying Demonstrations were given against various insect pests throughout the year, and it is gratifying to note that the effect of these sprays in mitigating the attacks of insect pests was thoroughly appreciated. In one fruit garden near Karradah it proved possible prevail on the owner to spray his peach trees against Aphis at his own charges and under supervision of the Entomologist only. The work was thoroughly and effectively done.

The bulk of the work of this Section, however, has been the study, collection, mounting, and, so far as possible, the identification of insects of economic importance. Some hundreds of such species have been collected

and information with regard to their life histories, time of attack etc., has been tabulated. Previous to his return to India the Assistant Entomologist was engaged in the task of consolidating all this information as a paper on "Economic Insects of Iraq."

Unfortunately he was taken seriously ill in November last and on his discharge from Hospital was returned direct to India on medical grounds. The material for his paper is with him, and the paper will be completed in India, and sent out to this country. This together with the named collection will form a valuable basis for future work.

### MYCOLOGY.

The year's work consisted chiefly of the identification of the various fungoid diseases of crops together with some attempt to estimate their relative economic importance. Owing to lack of transport facilities the areas visited are limited but the Baghdad Area has been well scoured. The results of the observations for 1920 will be presented as a Paper on "A Preliminary Survey of the Fungoid Diseases of Plants in Mesopotamia." This paper is as yet incomplete but will be forwarded from India by the Assistant Mycologist when he has been able to verify some of his identifications. Amongst the most important fungoid diseases identified during the year were the following:—

#### COTTON.

Sore shin Fungus particularly on seedlings which owing to bad tilth or deep sowing cannot easily emerge from the ground.

Various leaf diseases appear at a much later stage in the life history of the cotton plant but these are of little importance since the attack does not take place until October.

- (1) Black Mould (*Aspergillus* Sp.).
- (2) White Mould (*Rhizopus* Sp), and
- (3) Brown Mould (*Alteraria* Sp)

have all been observed on the bolls of the plant.

#### WHEAT.

Black Rust (*Puccinia Graminis*),  
Brown Rust (*Puccinia Glumarum*) and  
Orange Rust (*Puccinia Tritieca*)

have been observed, and all do great damage.

Loose Smut (*Ustilago Tritici*) and Stinking Smut (*Tilletia Tritici*) are also common and the former probably does more damage.

#### BARLEY.

Rust and Smuts both loose and covered have been observed and loose smut does considerable damage. Plots have been laid out on the Experimental Farm with a view to testing the efficacy of the usual methods of control of these diseases.

Late Blight (*Helminthosporium Teres*) is perhaps a very serious disease in this country. Many specimens were received in 1920.

#### SORGHUM.

Both Short and Long Smut are deplorably common on the Sorghums both local and imported.

#### RICE.

Burnt ear disease was very prevalent in 1919, but no specimens of this disease were received during 1920.

#### GROUND NUT.

Tikka leaf spot (*Cercospora Personata*) has been observed.



## DATES.

Leaf spot and Smut are important diseases.

## CITROUS.

Die-back is the most serious fungoid disease. It is caused by a *Phoma*, and has been observed on the leaves where it forms patches of leaf spot. Spraying with 2 per cent Bordeaux mixture would probably prove an efficient check. Gummosis and Canker have also been observed.

## GRAPE.

Leaf spot (*Cercospora Viticola*) is the most serious disease.

## PEACH AND NECTARINE.

Leaf curl caused by "*Exoascus Deformans*" is a very serious disease of these crops. It appears to be spreading very rapidly in the orchard districts around Baghdad. Spraying with Lime Sulphur or Bordeaux mixture would probably be effective, though great care would have to be exercised so as not to scorch the leaves.

## APPLE.

Scab on apple is almost universal.

In addition to these diseases a large number of fungoid diseases of greater or less importance were noticed on the vegetable crops of the Baghdad District.

Spraying experiments were carried on throughout the year with a view to determining the strength of spray that could be used without detriment to the leaves. It was found that lime sulphur solution of Specific Gravity 1.005 to 1.01 could be safely used.

J. F. WEBSTER,

*Deputy Director of Agriculture*  
(Research.)

BAGHDAD,  
February, 1921.

## APPENDIX III.

## Administration Report of the Agricultural Circle Officer, Diala.

### A.—GENERAL REMARKS.

#### STAFF.

During more than half the year the total Staff consisted of Circle Officer, one Farm Manager and one Clerk. The dates of transfer, etc., are given below :—

- C. Gautby, Circle Officer remained in charge throughout the year.
- Sabri Anwar, Agricultural Assistant, joined 10th July 1920, repatriated 5th September 1920.
- R. S. Rizkalla, Agricultural Assistant, repatriated 3rd September 1920.
- Ghulam Hussein, Agricultural Assistant, joined 6th March 1920, transferred 2nd June 1920.
- E. E. Miles, Farm Manager, repatriated 14th June 1920.
- J. Fernandez, Assistant Farm Manager, joined May 1920.
- E. A. Fernandez, Clerk, repatriated 18th May 1920.
- D. R. Swamy, Clerk, joined 18th May 1920.

#### CLIMATE.

Very little of a definite nature can be stated regarding the season under report as no records exist with which to make comparisons, either with other years, or other districts. Unusually low temperatures were experienced in the first month resulting in serious damage to most citrus trees north of the Jabal Hamrin. In December frost combined with strong westerly winds in the Ba'qubah area killed citrus trees in exposed situations.

In the daim or unirrigated areas of this Circle rainfall was not sufficient to ensure an average crop of wheat and barley. The 1920-21 crop also suffered from lack of rain after germination. Large areas are reported to have dried out after germination and had to be resown after the next rain.

The desert grasses, and legumes made little growth and most cereal crops had to be grazed until late in the season to carry the stock until the swamp grasses were obtainable.

In the Sulaimani District thunder showers during April and May prevented the early ripening of grain crops and the drying of pastures experienced in other areas. Hail storms did slight damage to grapes and tobacco during May.

#### IRRIGATION.

On the whole the water supply has been as satisfactory as could be expected with the existing canals. During February some crops on the Khallis Canal suffered lack of water, and during June and the early part of July rice and fruit were injured by the failure of the Khorassan and Mahrut Canals.

#### CROPS TESTS.

On all irrigated areas barley, wheat, Vetches, Rice and Beans made good growth, small areas of Rice failed owing to lack of water in June. On 'Daim' land crops were generally poor. Metre samples were taken of wheat and barley to determine average yields, with results as follows.

	Wheat.	Barley.
	Kilo per donum.	Kilo per donum.
Ba'qubah District	375	539
Kirkuk District	220	225
Sulaimani District	243	479
Khaniqin District	No tests owing to lack of transport.	

\* Donum =  $\frac{1}{2}$  acre.

No tests or weighings were possible with rice and fruit owing to the disturbed state of the country.



## B.—BA'QUBAH EXPERIMENT STATION.

The work of the Ba'qubah Experiment Station was continued on the same site as last year. Additional experiments were however undertaken and the work proceeded satisfactorily until June when the shortage of water in the Khorassan Canal began to be felt. Following shortly after this the disturbances made work very difficult for a time, and on August 12th the Station had to be evacuated. It was re-occupied on September 1st, but in the meantime all crops had suffered and the work done on cotton and other summer crops was wasted.

The following experiments were laid down during the year:—

- (1) Varietal Test of Local and Imported Wheats—(6 varieties).
- (2) Varietal Test of Cotton. (6 varieties).
- (3) Ridge *versus* Flat Test with cotton. (2 varieties).
- (4) Test of Groundnuts under three different methods  
of cultivation (4 varieties).
- (5) Varietal Test of Local, Indian, and African Maize.

The following crops were also sown for seed production:—

- (1) Punjab 15 wheat.
- (2) "Mesopot White" Cotton.
- (3) Lucerne (Alfalfa).
- (4) Oats.
- (5) Safflower.
- (6) Hibiscus.

In the Tree Nursery the following varieties of shade and Timber trees were raised:—

- (1) *Acacia arabica*.
- (2) *Cassia auriculata*.
- (3) *Cassia catechu*.
- (4) Euphrates Poplar.
- (5) White Poplar.
- (6) *Dalbergia Sissoo*.
- (7) Indian Ash.
- (8) *Terminalia tomentosa*.
- (9) *Schinus molle*.
- (10) Leguminosae.
- (11) *Sesbania Egyptiaca*.
- (12) *Prosopis*.
- (13) *Rubia prunedacacia*.
- (14) Willow.
- (15) Mulberry.
- (16) *Terminalia*.
- (17) *Pinus longifolia*.

## VARIETAL TEST OF WHEAT.

The wheats were all sown on 1/40 acre plots in five series.

The average yields worked out as follows:—

Cross. 3	1380 lbs: per acre.
B 8	1370 " "
A 8	1330 " "
Punjab.	1320 " "
Arab.	1140 " "
A 113	1025 " "

All other experiments were ruined during the period the Station was in the hands of the tribesmen. No results can therefore be given.

Since September 1st three crops have been sown.

*Varietal test of wheat*.—Sown on 1/20 acre plots in five series. The varieties sown were:—

- Punjab 11
- Punjab 15
- A 8
- B 8
- A 113
- Cross 3

All varieties germinated well and are making satisfactory growth.

*Late of Sowing Test with Berseem* (Egyptian Clover).—Sowings were made on 1/40 acre plots in five series.

Five being sown on each of the following dates.

1st sowing October 20th.  
2nd     "     "     30th.  
3rd     "     November 9th.  
4th     "     "     19th.

The first three sowings germinated in three days; the last one took 8 days. Plots sown on October 20th and 30th have made good growth. The two later sowings appear to have been checked by the cold weather.

*Hurtman* (*Lathyrus sativa*) was sown on October 25th as a green manure crop for the 1920 cotton and has made excellent growth.

#### LIVE STOCK.

Six draft mules were stolen from the Testing Station during the disturbances five of which have been recovered.

#### BUILDINGS.

All buildings containing timbers of any value were also wrecked and the timbers stolen. None of these were recovered.

#### LABOUR.

Arab and Kurdish labour was employed and gave satisfactory service. Reliable overseers are still very much needed.

The programme for 1921 includes experimental plantings and sowings of the following crops:—

- (a) Cotton.
- (b) Flax.
- (c) Berseem.
- (d) Maize (Local and Imported varieties).
- (e) Shade and Timber Trees (Local and Imported varieties).
- (f) Fruit Trees. (Local and Imported varieties).
- (g) Wheat. (Local and Imported varieties).
- (h) Barley. (Local and Imported varieties).

It is proposed to institute an investigation in and near Ba'qubah, the object of which is to determine some of the more important points in the economics of fruit growing in this District.

Three orchards, typical of this area have been selected.

No. 1 is in very good condition and has been exceptionally well cared for since the time of planting.

No. 2 is in fair condition, but capable of considerable improvement.

No. 3 is in the neglected and run down state which is usually the corollary of a frequent change of tenants.

The scope of the investigation includes the following:—

- (i) To determine the average water requirements per acre of typical orchards.
- (ii) To find what are average yields.
- (iii) To discover the cost of improvements and to what extent they are profitable.

#### C.—NOTES ON A CROP SURVEY OF THE DIYALAH AGRICULTURAL CIRCLE, 1920.

Apart from the routine and administrative work of the Circle, all available time during the year under report was occupied in making a general survey of the crops and methods of cultivation followed in each District—special attention being paid to the fruit crops.

Many different types of farming are practised, varying from the hill farming of the Sulaimani District, with tobacco and fruit as the cash crops, to the specialised farming of the Diyalah Fruit Belt. Considerable time was also spent in carrying out crop tests to determine average yields of the more important crops; separate reports on which have been submitted from time to time. Most of the month of April was spent on the Anti-Locust campaign in the Mosul Circle.



The work on the crop survey was seriously hampered by lack of transport and the disturbed state of the country, and it is a matter for regret that during the latter half of the year, little work was possible outside the Ba'qubah District. In these circumstances the work begun in the Khanaqin, Kirkuk and Sulaimani Districts could not be continued; and the notes on the crops of those areas are therefore not nearly complete. Hopes are however, entertained that it will be possible to resume the work during 1921.

The boundaries of the Diyalah Circle coincide approximately with the boundaries of the area comprising the three Political Divisions, Sulaimani, Kirkuk, and Diala. The Circle is divided naturally into four districts: each with a distinct type of cultivation, suited to its soil and climate.

*Ba'qubah District*—is sub-tropical and arid and practically all crops are grown under irrigation.

*Kirkuk District*—is semi-arid, but can grow winter crops without irrigation.

*Sulaimani and Khanaqin Districts*—are semi-humid and can grow all winter and many summer crops without irrigation.

## BA'QUBAH DISTRICT.

### TOPOGRAPHY.

A flat plain, with a slight gradient from the range of hills known as the Jabal Hamrin, towards the River Tigris. The evenness is broken by the Diyalah River and the numerous canals flowing from it on both its banks; otherwise there is no outstanding feature to break the evenness of an almost level plain. No natural or artificial drainage exists; except within a few hundred yards of the Diyalah where seepage into the river helps to get rid of surplus irrigation water.

### CLIMATE.

Seasonal temperatures are extreme, 115deg.F. during the summer and 5 degrees of frost in the winter, not being uncommon. During the summer diurnal temperatures are also extreme. Hot N. & N.-W. winds often check plant growth during July and August. Rainfall is usually below 12 inch for the year. Most of which occurs during the months of December, January, and February. Slight falls of snow have been known but are very rare.

### SOIL.

There is unusual uniformity in the soil of this district. The prevailing type is a heavy loan, which behaves almost like clay when wet, and cakes badly on drying. No sandy soils are present; the lightest being a fine silt.

### CROPS GROWN.

Dates, and citrus fruits are the most important crops. Other fruit crops grown on a commercial scale are, peaches, grapes, plums, figs, apricots, apples and pomegranates. Pears, cherries, nectrines, quinces, and mulberries are also grown, but in small quantities. Wheat, barley, beans, and vetches are the main winter crops; while rice, maize, cotton, gram, and lentils are the important summer ones. During the summer nearly all sub-tropical, and many tropical crops, can be grown; and during the winter most crops from the temperate zone do well.

## FARM CROPS.

### BARLEY.

Among cereal crops barley is the most extensively grown. It forms the staple food for both the farmer and his stock. The main reason for its being grown more largely than wheat appear to be (1) Freedom from diseases. (2) Is a more certain crop. (3) The straw and chaff (tiben) are more valuable as a stock food. The economics of wheat and barley cultivation are being inquired into, but so far without any conclusive result.

Six distinct varieties have been observed so far. They are, however, rarely grown separately. The average barley crop in this area is a mixture of several different 4 rowed and 6 rowed varieties. 2 rowed varieties are rarely grown.

## SOWING.

The preparation of the seed bed is a very simple operation as carried out here. It consists merely in irrigating the ground and as soon as dry enough ploughing it once with the local plough; which leaves it in small ridges. The seed is broad casted and covered by cross ploughing. Sowing begins about the end of October and is continued to the end of January.

## IRRIGATION.

The crop is usually irrigated soon after the seed has germinated. If irrigated before germination the ground bakes hard on drying and the young plant has difficulty in forcing its way through the hard surface. Subsequent irrigation are dependent on the rainfall. Usually 3 or 4 waterings is all the crop will require to bring it to maturity.

## HARVESTING.

Harvesting usually begins about the second week in April and continues throughout May.

The sickle is the only harvesting implement used. As a rule the whole family turns out to help with the harvesting. The man and his wife cut the crop and the children collect it into small heaps ready to be carried to the stock. The carrying is mainly done by donkeys and bullocks.

No wagons or forks are used.

## THRESHING.

The method of threshing is the same as was practised centuries ago; the grain being merely trodden out by bullocks or donkeys, and winnowed by the wind. Threshing is usually begun immediately after harvest.

## DIVISION OF THE CROP.

After threshing and winnowing the crop is divided into shares, according to the number of people concerned in the financing or growing of the crop and also according to whether land is privately or Government owned.

The most common methods of division are:—

(1) On Government land.

The crop is divided into three equal shares  $\frac{1}{3}$  is claimed by the Government as tax.  $\frac{1}{3}$  goes to the man who finances the growing of the crop.

The remaining  $\frac{1}{3}$  is left for the men who have done the work of sowing and cultivating.

(2) On privately owned land.

The crop is divided into 5 equal parts, 20 per cent. is taken by Government as tax. 20 per cent. goes to the man who owns the land. 30 per cent. to the man who supplies the seed and plough animals. 30 per cent. to the men who grew the crop.

In addition to these two main methods of division there are numerous variations of them. On certain kinds of Government land 40 per cent. of the crop is taken instead of  $33\frac{1}{3}$  per cent. as tax. In some parts too the man who does the threshing and winnowing takes  $4\frac{1}{2}$  per cent. of the crop, and the tribal coffee maker and plow maker each takes 1 per cent.

During the last two years the Government tax has been taken in money instead of in kind. The amount to be taken is based on an estimation of the crop, usually either in the field or in the stock. The cash value of the Government share is then calculated on the average price of grain in that year; known as the conversion rate.

This method leaves much to be desired in the way of simplicity and fairness, but until more detailed information is to hand, as to average yields, profits, etc., other methods appear to be unworkable.

The farmer's position as regards taxation does not appear to be an enviable one, compared with the position of other industries. To be taxed as high as 40 per cent. of the gross output is a severe strain on any industry. On an output so dependent on water supply, favourable weather, and freedom from diseases such a tax cannot do other than greatly hamper the basic industry of the country.



## SEED RATE AND YIELD.

So far as is known at present the average seed rate is approximately 80 lbs. per acre. Higher seed rates are quite common. In some cases as high as 120 lbs. per acre. The reasons for this appear to be—(1) the inefficient method of covering the seed (2) the presence of enormous numbers of birds; particularly crows and sandgrouse.

The yield that have been weighed have varied from 135 lbs. per acre to about 2,200 lbs. per acre.

\* As computed from square metre cuttings.

## WHEAT.

Small areas of *T. durum* (Macaroni wheat) are grown, but most of the wheat in this district is of the *T. vulgare* (Bread wheat) type. No pure crops of any particular variety have been observed; and all the varieties sown are of the awned type, most of them with white grain. Six distinct varieties were collected during the 1920 harvest. Methods of cultivation harvesting, threshing and division of the crop are the same both for barley and wheat.

## BEANS.

The variety grown as a field crop and known locally as Bajilla is similar to the "English Horse Bean" or Winter Bean. It is usually sown with barley, about 50 lbs. of beans and 40 lbs. of barley to the acre. The Barley is cut as green fodder and will usually give three cuttings during the season. The beans are either picked by hand or the whole plant is pulled and afterwards threshed. The remaining barley is then grazed off by sheep and goats. No figures as to average yields of beans and green fodder are available.

## VETCHES.

Similar to the Winter Vetch grown in western countries. Only one variety has been observed. It is sown, harvested, and threshed, in the same way, as are wheat, and barley. Its main use is as a cattle food, though to a certain extent it takes the place of gram as human food. The value of the Vetch as a soil renovater does not appear to be recognised.

## RICE.

Stands next in importance to barley, as a food crop. All the rice is grown under the wet method; which is in brief, as follows:—

A small bund is built round the field, with cross bunds at intervals of about 20 yards. The field is then flooded and the seed sown in the water. About 2 inch. to 3 inch. of water is kept on the field throughout the growing season. If possible the water is changed 2 or 3 times during this period. Just before harvest the water is run off and the crop harvested and threshed in the same way as wheat and barley. In this District Rice is sown during April and May and harvested during October.

## MAIZE.

The quality of the maize grown is distinctly poor. The plant is of the dwarf type, usually with 3 to 5 "tillers." It rarely grows more than 2 feet 6 inch. in height. Sowings are made during April and May and the crop harvested in July and August. Later sowings are made in June after a grain crop, and harvested in October. Jowar (*Andropogon Sorghum*) is also grown, though not to any great extent. Jowar is usually harvested in October.

Experiments have shown that Indian and American maizes sown at the same time as is usual for the early crops of the local variety rarely develop seeds. It has been suggested that the reason for this is that conditions at that period are in some way unfavourable for proper pollination or fertilization of the flowers. Indian and American varieties give good results if sown in July or early August. A keen demand exists for seed of these varieties from cultivators who have seen them growing on the Ba'qubah Testing Station.

## COTTON.

The Cotton Expert in his "Report on Cotton Experimental Work in Mesopotamia for 1919," writes of this District. "This tract is one of the two fairly large areas which hold out greatest prospects for the early extension of the commercial cultivation of cotton." Further information on the subject is given in that report.

Sesame, Gram, and Lentils, are also grown as field crops but only on small areas and mainly for home consumption. Most sub-tropical and certain tropical vegetables are grown, and most vegetables from the temperate zones—with the exception of potatoes are successfully cultivated. Potatoes have proved a difficult crop to grow.

## FRUIT CROPS.

In this District Fruit-growing is by far the largest, and most important industry; both in point of capital invested and percentage of population engaged. The Diyalah Fruit Belt is the centre of this industry.

It comprises a strip of land on the left bank of the Diyalah River, about 20 miles in length, and varying in width from 1 to 3 miles; it extends from the village of Buhriz to Shahraban; and includes Ba'qubah, Hwaidir and the villages along the Khorassan Canal. The land in this area is devoted almost exclusively to various types of fruit growing; of which citrus culture is the first in importance.

The history of the development of the industry is very difficult to trace. The first plantings are reputed to have been made over 2,000 years ago. Naturally none of the original trees now exists. The oldest trees now in bearing are those of Seville oranges (Narinj) which are over 100 years old. Oranges were probably introduced about the 9th Century.

As a means of livelihood Fruit growing probably compares very favourably with any other form of Agriculture in Iraq. No exact figures are yet available as to costs of production, yields, and profits, but judging from weighings and crop experiments already carried out it is clear that a well-managed orchard will give a yield to the gross value of about Rs. 3,600 per acre in a normal year. In a season of heavy crops and high prices like the year 1919 many orchards yielded more than double this amount per acre.

The relative profits obtained from dates, citrus fruits and sun fruits are still unknown, but all indications go to prove that citrus fruits are the most profitable crop and that sweet oranges are the most profitable citrus crop. The 1919 crop was a particularly good one and investigations in a number of gardens gave the average yield of oranges on mature trees to be over 500 per tree. These at current prices were worth in the orchard Rs. 7 per 100 or Rs. 35 per tree. An acre of permanent orchard will contain about 100 date trees and about 120 orange trees. With dates selling at Rs. 12 per tree and oranges at Rs. 35 per tree the gross yield per acre would be  $120 \times 35 + 100 \times 12 = \text{Rs. } 5,400$  per acre. The year 1919 was one of heavy yields and good prices, and the average over a number of years is estimated at about  $\frac{2}{3}$ rd the above figure or Rs. 3,600 per acre. It is estimated that one man with a family to help in the picking season can do all work necessary on 8 to 10 acres of orchard.

## DATES.

In this district as in all Mesopotamia to the south of it, Dates are the most extensively grown fruit. No points of importance distinguished the Dates of this area from those of the remainder of Iraq. Similar varieties are grown, and the methods of cultivation are the same. Both varieties and methods have already been described by another member of the Dept., and it would therefore be useless to repeat the work here.

The district marks the northern boundary of the Date growing area of Iraq.

## CITRUS FRUITS.

Eight different kinds or species of citrus fruits are grown in this district.

- (1) Sweet Oranges.
- (2) Tangarine.
- (3) Seville Orange.
- (4) Sweet Lime.
- (5) Sour Lime.
- (6) Lemon.
- (7) Citron.
- (8) Pomela.



Sweet oranges and sweet limes are the most extensively grown citrus fruits and apparently the most profitable ones.

### SUN FRUITS.

Among Sun fruits, *i.e.*, fruits that can be grown without the shade of dates, or other trees, Grapes are the most largely grown, and probably the most profitable crop. Twelve distinct varieties are grown in this district. Eight of them appear to have considerable commercial value. "Ajaimi" and "Dais al Anz" are the two most extensively grown for the Baghdad market.

### POSSIBLE IMPROVEMENTS.

Very little attention has so far been paid to the selection of desirable "Strains" of any type of Citrus fruit. Great improvements—especially in sweet oranges and tangarines—are possible by careful selection and propagation of the best strains. As already mentioned excellent varieties exist and would well repay the work of selection and propagation to establish standard varieties. There is at present no great need for the introduction of new varieties into the country. The only exceptions that can be recommended at present are:

- (i) a good Navel orange,
- (ii) a good thin skinned variety of lemon.

These should however only be introduced under the strictest control of the Department of Agriculture. This is essential in order to avoid the possibility of the introduction and spread of such diseases and pests as scab and citrus canker which have been the cause of enormous losses to citrus growers in other countries. No pests or diseases of economic importance have been observed among the fruits of this District.

### FUTURE DEVELOPMENT.

The possibility of developing an export trade in citrus fruits is still undetermined. The development of the industry would necessarily involve modern methods of cultivation, grading, packing, and transport. With modern methods would also go the full use of all profitable outlets such as the preservation of the fruits (candied), the manufacture of lime juice, oils, and perfumes. In other citrus growing countries—the manufacture of "Oil of Lemon" is regarded as the most profitable use for second grade fruits.

To organise an export trade good shipping facilities would be necessary. Quick transit, careful packing, and good storage are essential to success.

### CONCLUSIONS.

The study of fruit culture in this country being still in its early stages an enormous amount of experimental work and research is necessary before it can be asserted that any particular method of cultivation is an improvement on the one practised by the local growers. Sufficient progress has however been made to warrant the following tentative conclusions:—

- (1) That the fruit crop is of sufficient economic importance to warrant the closest attention possible.
- (2) That excellent varieties exist in the country and should be standardized.  
New varieties should only be introduced under the strictest Departmental control.
- (3) That the most profitable distances of planting and methods of 'Lay out' demand further study and experiment. Methods of pruning need to be tested.
- (4) That modern methods of picking, grading, storing, packing and marketing could, with slight modification to suit local conditions, profitably be adopted.
- (5) That a fruit experimental station to test and demonstrate improved method is necessary.

That such a station would be paid for many times over by the increase in revenue due to greater production.

- (6) As water, and not land is the limiting factor in Agricultural Development over the greater part of this country, the yield per unit of water applied, rather than the yield per unit area of land determines the value of a crop. "Yield per acre" should be subordinated to "Yield per acre-inch of water".

## KIRKUK DISTRICT.

## TOPOGRAPHY.

A slightly rolling grassy plain, with a general gradient towards the River Tigris; and intersected by numerous small rivers and streams. The cultivable part of the district is roughly triangular in outline and is bounded on the north-east by the Lesser Zab River, on the south-east by the Jabal Hamrin and on the west by a stretch of mountainous country extending to the Persian border. The area is as a rule naturally well drained, but conservation of the water supply is necessary before much further development in summer crops is possible.

## CLIMATE.

Maximum and minimum temperatures of summer and winter are about the same as in the Diyalah District, but as a rule the summer season is shorter and the winter longer than in the Diyalah District. Frosts and light falls of snow are not uncommon during January and February. Rainfall average about 13 ins. during the year; the greater part of which occurs between October and March.

## SOIL.

Along the streams and rivers gravelly loams predominate; on the open plains the soil varies from clay loam to light gravel. The prevailing type of the District is a medium loam of considerable depth, overlying a heavier subsoil.

## CROPS GROWN.

Wheat is the main crop of the District; other field crops extensively grown are, barley, rice, maize, cotton and tobacco, grapes, olives, apricots, and most subtropical and temperate zone vegetables are also important crops.

## IMPLEMENTS AND MACHINERY.

The implements used are in general similar to those of Lower Mesopotamia though the plough used is a distinct improvement on the one used below the Jabal Hamrin. The construction is similar but the blade is broader and therefore more efficient as a 'weed eradicator'. Better results would probably be obtained however with a 'turnover' type of plough, as it would avoid the ridging effect of the local plough and thus conserve more of the soil moisture.

A keen demand appears to exist in this area for modern Agricultural machinery. Thousands of acres of good "drain" or unirrigated land is lying idle owing to lack of sufficient labour and animals to cultivate it under the local methods.

## SULAIMANI AND KHANAQIN DISTRICTS

It is regretted that circumstances—in the shape of bad transport facilities and the disturbed state of some parts of the country—have made a complete survey of these districts impossible. Hopes were entertained in the early part of the year of being able to pay close attention to the fruit and to baccho crops—particularly those in the Shar Bazhar and Halebja areas—with a view to devising improved methods of drying and packing. These hopes have unfortunately not been fulfilled and the work has had to be postponed to the coming year.

(Sd.) C. GAUTBY,

*Agricultural Circle Officer, Ba'qubah.*

BAQUBAH:

*March, 1921.*





## APPENDIX IV.

## Administration Report of the Agricultural Circle Officer, Lower Tigris.

## STAFF.

The office of the Agricultural Circle Officer, Lower Tigris, was taken over by me on 9th January, 1920, from Captain V. H. W. Dowson who proceeded to Baghdad. The Headquarters of the Circle were at 'Amarah at this period.

Mr. E. A. Kinch was posted as Assistant Circle Officer, Lower Tigris on 27th July, 1920.

Abdul Karim bin Hamdi, Arab Assistant to the Agricultural Circle Officer, has been working in the Lower Tigris Circle since 13th September, 1918. He was sent on special duty with Political Officer, Basrah, from 23rd August, 1920, to 12th October, 1920, to assist Mr. Yusuf Ali Khan, Assistant to Economic Botanist, Punjab Government, in exporting Date Trees to India.

Clerk V. R. Ghaisas who has been working in the Lower Tigris Circle since 11th November, 1918, proceeded on leave to India on one month's leave against Contract from 28th November, 1919, to 23rd February, 1920, and during his absence Clerk Iqbal Singh officiated.

## CLIMATE AND ITS EFFECTS.

Mild weather was experienced during the early part of the year and the shitwi crops on lift irrigation got well ahead. The temperature rose gradually towards the latter part of February after rains and the germination of the late shitwi was greatly facilitated. During May and June hot dry winds considerably retarded growth of the young saifi crops unprotected by adequate wind screens. Abnormally early frosts were experienced in October and November which did some damage to the late saifi and also badly nipped the early Berseem sowings.

## RAINFALL AND IRRIGATION AND THEIR EFFECTS.

During the first few weeks of the year the rainfall was lamentably low and the winter crops badly needed more rain. Towards the end of February sufficient rain fell to germinate the late shitwi sowings and to carry them on until free flow irrigation was possible. The flood season began on the 8th-9th March and made free flow irrigation general. Up to this date the high level canals had been dry and consequently the shitwi was backward. This was particularly noticeable down the Shatt-al Gharraf.

There was a steady fall in the river towards the latter part of May and throughout June and flow irrigation from the high level canals became impossible. From mid-June to the end of the year lift irrigation only could be carried on by means of the pump and cherid. The first Autumn rain to appreciably benefit Agriculture occurred at Kut on 25th/26th October which made ploughing for the shitwi crop general throughout the District. November and early December were dry and rain was badly needed to germinate the sowings of wheat and barley and it was not until the night of 10th/11th December that a good rain was experienced. The shitwi crop not irrigable by pump and cherid suffered in consequence and a few cases of re-sowing are recorded.

## HARVEST OF PRINCIPAL CROPS.

## SHITWI (WINTER.)

The harvesting of wheat and barley only became general throughout the Circle about the second week of May and quite extensive areas of "Marwi" on the Tigris and Shatt-al Gharraf were not harvested until June. The chebis cultivation of wheat and barley by basin irrigation, of which there is a good deal on the Shatt-al Gharraf was harvested during the latter part of April and early May.

Two hundred and ten square-meter cuttings both of chebis and marwi wheat and barley were made on various maquatas down the Shatt-al Gharraf. These cuttings were forwarded to Baghdad for threshing and weighing individually. The results of only half the cuttings have been received up to date.



At Qalat Sikar on the maquata of Sheikh Akdèyes es Subba the yield of chebis wheat was—

Grade I	..	917.8	Kilos per donum of 5/8th acre.
Grade II	..	546.5	„ „ „ „
Grade III	..	260.7	„ „ „ „

#### SAIFI (SUMMER.)

The saifi crops on the Shatt-al Gharraf—Dukhan, Simsim, Mash and Idrah were not as good as previous years probably due to the low floods and their short duration which only made free flow irrigation possible for a short period on many of the canals running off the Upper Gharraf.

The earliest dukhan harvest was seen on the maquata of Shibl Beg between Qalat Sikar and Hai Town during the latter part of June.

At 'Amarah the rice crop has been good this year. The "Harfi" was decidedly better than the 'Effi' while the shital (transplanted) gave the heaviest yield.

At Bedra-Mirza Baad and Zoorbatiya the rice was poor and a large percentage of wild millet (Dinan) was present in the crop. The cleanest crop on the maquata of Said Hussain gave an approximate yield of 640 Kilos per donum of 5/8 acre.

An average Date harvest has been experienced this year. Samples of dates were collected from twenty-four different varieties of trees found in the gardens at Bedra and forwarded to the Deputy Director of Agriculture, Baghdad.

A plentiful supply of shitwi and saifi vegetables were grown in the vicinity of towns and no shortage has been experienced in the bazaar at 'Amarah, Kut, Bedra and Hai.

#### DAMAGE DUE TO PESTS, DISEASES, ETC.

##### A.—LOCUSTS.

The first appearance of freshly hatched peregrine locusts was reported in Bedra District on 19th March, 1920. The hoppers were observed in scattered masses at Gawari, which is close to the Mesopotamian-Persian border near post No. 32. The Rais Baladiyah, Zoorbatiyah, turned out all available labour to destroy them. Small trenches were dug and the hoppers driven into them by means of date palm branches. Another advantageous method adopted was the burning of the hoppers with Kerosine and dried grass. On the 30th March a similar report was received from the Jessan Canal. These like the Guari hoppers were found in small scattered masses spread over a considerable area which made them difficult to deal with.

During the early part of April several somewhat indefinite reports were received by the Assistant Political Officer, Bedrah, of "hoppers" on the Persian side of the border and the representative of the Wali of Pusht-i-Kuh was approached on the matter. By the 20th April, 1920, it was estimated that 90 per cent. of the hoppers in the Bedra District had been destroyed.

Very little damage was done to the young shitwi by these hoppers. On the 11th May flying locusts were reported at Zoorbatiyah coming from the Pusht-i-Kuh, but little damage was done to the shitwi as the grain was already dry. Some of the young saifi was destroyed.

##### B.—RUST.

Considerable damage was caused to the wheat (Marwi) by rust in the Shatt-al Gharraf Districts. Both yellow rust (*Puccinia Glumarum*) and black rust (*Puccinia Graminis*) were identified. Specimens of diseased plants were collected at Qalat Sikar and Hai and were forwarded to Deputy Director of Research, Karradah, Baghdad. It is of interest to note that the chebis wheat was free from the disease.

##### C.—SMUT.

Specimens of "loose smut" in Barley were collected from badly attacked crops at Hai and Qalat Sikar and forwarded to Deputy Director of Research, Karradah, Baghdad.

##### D.—COTTON

Cotton bolls were collected at Zoorbatiyah, Bedra, and forwarded to Deputy Director of Research, Karradah, on 20th October, 1920.

## E.—GRAIN-SMUT IN IDRAH.

Was found amongst a shital (transplanted) crop of Idrah at Qurnah on 14th November, 1920, and forwarded to Deputy Director of Research, Karradah, Baghdad.

## FODDER SUPPLY AND CONDITIONS OF STOCK.

Grazing has been comparatively scarce this year in the Kut and Shatt-al-Gharraf Districts. What grass there was grew along canal banks and amongst the corn crops. At Ali-Gharbi, Amarah grass was plentiful and attained a good growth.

Dry fodder (*boosa*) was difficult to obtain during the latter part of the year and the price was high. Up to Rs. 50 per ton has been obtained for boosa in the Kut market.

At 'Amarah boosa (rice straw) was plentiful throughout the season.

Ploughing stock have had a hard year and their condition has varied from fair to good. Cattle and sheep throughout the Circle have kept in good condition in spite of the grazing and fodder scarcity.

## SPECIAL REPORTS.

(a) *Shatt-al-Gharraf—Shatra and the Bedda Scheme.*—The Bedda channel at the foot of the Shatt-al-Gharraf was bunded up the previous low water season with a view to forcing extra water down the Shatra channel in the high flood season and so scour the channel which has been gradually silting up. The bund was not cut until it was too late for the water to benefit the shitwi sown down the Bedda canal. Fortunately the shitwi crop is not an extensive one and the water was in time for the rice sowings.

On the 20th May accompanied by Capt. Crawford, Assistant Political Officer, Qalat Sikar, I inspected the maquata "Sudaifa" Yusuf al Burham of the Atab tribe. The wheat and barley on this maquata had suffered through the lack of water during the early period of growth. A number of meter tests were taken and the average yield of wheat was only  $4\frac{1}{2}$  cwt. per acre.

On the 21st May I proceeded to Shattra to carry out some meter test for the Political Officer, Nasiriyah. The political situation did not permit my taking any cuttings, so I returned to Karradi and Qalat Sikar.

Between 15th May and 13th June a prolonged tour of the Gharraf was made. Many muqatas were visited and two hundred and ten square meter cuttings of chebis and marwi wheat and barley taken. Selections were made from ears of wheat and barley possessing special characteristics for propagation on the Experimental Station. Specimens of various diseases were collected and forwarded to Deputy Director of Research, Karradah, Baghdad.

(b) *Land Development Scheme, Keteban, Basrah.*—A detailed progress report was forwarded to Deputy Director of Agriculture, Baghdad, on 26th November, 1920. It is the first commercial enterprise of its kind and many landowners are watching the progress of the scheme with considerable interest. Mr. Gabriel has made considerable advance in the immediate development of the estate inspite of being confronted by many difficulties.

(c) *Swaib Land Development Scheme, Qurnah.*—This scheme which originated from the Shaikh of Swaib is to bring under cultivation 5,000 acres by means of erecting a pumping station on the Swaib river two miles from the outlet into the Shatt-al-Arab.

Accompanied by the Assistant Irrigation Officer, 'Amarah, I inspected the land on 11th November, 1920. Proposals for developing the estate were drawn up and forwarded to the Deputy Director of Agriculture, Baghdad, under my No. 39/1023, dated 20th November, 1920.

(d) *Gurmat Ali Land Scheme.*—Jemal Beg is desirous of having a bund built from Gurmat Ali creek and Shiba bund; thus preventing the waters from the Euphrates spreading over part of his estate. Proposals for the scheme were forwarded to Deputy Director of Agriculture, Baghdad, under my No. 39/1033, dated 23rd November, 1920. The cost of the bund and outlay in a suitable reclamation scheme compared to the area of land brought under cultivation does not appear to justify the scheme at present.

## NOTE ON CHEBIS CULTIVATION, SHATT-AL-GHARRAF.

As a supplement to my monthly report for November, 1920, I forward a note on chebis cultivation by basin irrigation. There are extensive areas of chebis wheat and barley grown in the Shatt-al-Gharraf from which high yields of grain are obtained.



## EFFECTS OF REBELLION.

The rebellion did not in any way interfere with the shitwi sowing on the Tigris but on the contrary the high prices anticipated due to shortages on the Euphrates and elsewhere has stimulated competition in the Circle and a maximum area is being sown.

## KUT AGRICULTURAL TESTING STATION.

1. The site of the Kut Testing Station is situated one and half miles down stream of Kut Town and has a river frontage of 300 yards.

The total area of the Station is now 74 acres (Imperial Standard Measure) all of which is Tapu. Prior to being taken over by the Agricultural Department the land had not been under cultivation since 1914.

The Testing Station was first opened at Kut on 1st March, 1920, when 4 acres were brought under cultivation for Cotton growing and a further 6 acres taken up for the following shitwi experiments.

The soil is a light loam with traces of salt in the vicinity of old canals.

2. The land is irrigable by lift only and a double bukra cherid was erected for irrigation purposes when the Station was started. Later a 10½ H.P. Keighley Oil Engine and 6" Centrifugal Gwynne Pump was installed and the area increased to 74 acres.

3. The original idea in starting the Testing Station at Kut may be defined as follows:—

- (a) That certain Cotton Experiments conducted at the Baghdad Cotton Farm might be duplicated under the different conditions existing at Kut.
  - (b) That varietal experiments with wheats and barleys might be conducted with imported and 'Iraq seed.
  - (c) That selected commercial wheat might be propagated and a pure seed basis established.
  - (d) For the demonstration of modern implements likely to be of use to the cultivators.
  - (e) To open up a tree nursery.
4. The area put under cultivation during 1920—

(a) Summer Crop.			
1.	Cotton Varietal Test	.. ..	4 acres.
2.	Tree Nursery	.. ..	½ acre.
(b) Winter Crop.			
1.	Wheat Varietal Test	.. ..	2 acres.
2.	" Punjab II	.. ..	3 "
3.	" A 113 (C.P. 1919)	.. ..	3 "
4.	" Jassaniya (Local)	.. ..	1 acre.
5.	Barley	.. ..	2 acres.
6.	Berseem	.. ..	1 acre.
7.	Flax Seed	.. ..	4 acres.

## TESTING STATION STAFF.

Manager—Mr. Avedis Boyadjian.

1 Tindal—Salem bin Husain @ Rs. 2 per diem.

Permanent Cultivators 18 @Rs. 1-4 each per diem.

Oil Engine Driver 1 @ Rs. 1-8 per diem.

Guards 2 @ Rs. 1-4 each per diem.

The driver who was originally one of the labourers has been trained on the Farm to work the pumping set and is most satisfactory.

## BUILDINGS.

Some ruined buildings near the site (sun dried brick) formerly belonging to the Kut Bridge Head Staff were taken over and converted into—

- (a) Manager's Quarters.
- (b) Seed and implement Store.
- (c) Pump House.

When the erection of a pumping set was sanctioned a substantial pump house was built of the remaining sun-dried bricks from ruins in the vicinity.

	Rs.	A.	P.
Cost of Manager's quarters and Seed and implement Store	851	8	0
Cost of Pump House including foundations for Pump ..	421	2	0
The above includes the total cost of material plus labour.			

### CANALISATION.

When the Testing Station was opened on 1st March, 1920, a new system of high level and parallel channels were made to irrigate 4 acres of cotton and Tree Nursery. After the pump was sanctioned this system of canalisation was greatly enlarged upon—firstly to irrigate 25 acres and is now being made to embrace the whole 74 acres. A main high level canal—running parallel to the river and measuring 600 yards has been made. This will be extended to the boundary of the Farm in due course. Smaller channels taking off at right angles from the main feeder have been constructed.

### EXPERIMENTAL COTTON VARIETAL TEST.

The three acres of land brought under cultivation for this test were divided into 30 1/10 acre plots. Six varieties of seed were received from Baghdad.

#### *American Varieties—*

1. Webber.
2. Triumph.
3. Allen's Long Staple.
4. Punjab 285 F.

#### *Egyptian Varieties—*

1. Sakellarides.
2. Ashmouni.

Each of these varieties was duplicated five times on the "Chess board system" and as far as practicable each plot received uniform treatment.

The land was ploughed and then cross ploughed with the Monsoon ploughs followed by a double harrowing and boarding. After the third ploughing and harrowing a fine tilth was attained and the area was plotted out into 1/10 acre plots. The ridging was done by hand—ridges 2 ft. 6 inches apart—with a space allowance of 3 ft. 6 inches between each plot.

The plots were irrigated prior to sowing and the seed was dibbled in 2 ins. deep on the southern side of the ridges just above the water line. The interval allowed between the holes into which 6 to 8 seeds were put was 15 ins. The work with the "dibbling board" was found to be too slow and each man was provided with a pointed stick 15 ins. long with which he could measure the distance and construct a suitable hole for the seed.

Sowing commenced on 15th April and was completed on 20th April. The initial irrigation was given to all plots immediately after sowing, care being taken that the water should not submerge the seed holes but only reach the lower edges. Wind screens of Castor seed were sown along the canal running round the area and sun-hemp and jute sown between the plots.

On 24th April there was a germination of 70 per cent. throughout the plots. During May dry winds did considerable damage to the crop and killed many of the young plants which did not derive the benefit of the inadequate wind screens. At this stage water difficulties were being experienced and uniform irrigation of plots became impossible. The above factors are responsible for the high percentage of re-sowing which took place. The following are the re-sowings expressed in percentages of each series of 5 plots:—

Ashmouni .. .. .	19 per cent. re-sowing.
Sakellarides .. .. .	24 " " "
Webber 49 .. .. .	23 " " "
Allen's Long Staple .. .. .	19 " " "
Punjab 285 F. .. .. .	28 " " "
Triumph .. .. .	32 " " "

Some of the re-sowings did not germinate and many died soon after for lack of water and need of adequate wind screens to afford protection against the hot winds.

1st Irrigation .. .. .	15-22 April.
2nd " .. .. .	22-30 May.
3rd " .. .. .	4-12 June.
4th " .. .. .	14-21 June.
5th " .. .. .	23-30 June.
6th " .. .. .	Water supply failed.



Irrigation by Cherid was from the first a slow process and difficulties increased as the river level went down. Towards the end of May there was a lift of 9 feet and it was then realised that there was a probability of the Cherid being unable to meet the demand for water when most urgently required. As it was intended to extend the area of the Testing Station in the Autumn it became obvious that a pumping set was necessary and that it would be of considerable advantage to have it erected as soon as possible to help to meet the water requirements of the 1920 cotton crop, accordingly the matter was referred to Baghdad. During the latter part of June a sand bank formed in front of the "Cherid well" necessitating the digging of a channel out into the river. On the 31st July there was a channel 250 ft. long and a lift from the well of 22 ft. On the 1st August the well of the cherid collapsed and at the same time the greater part of the sandy wall of the channel leading to the river gave way, so absolutely preventing further irrigation until repaired. In view of the cost of labour and time it would take to clear the well and channel also the uncertainty of being able to save the already drought stricken cotton it was decided to abandon the cherid. At the time the decision was made there was a chance that the pumping set which had been sanctioned for the Testing Station might be erected in time to save the cotton; however such was not the case and the crop withered and died.

The pump was not erected until 10th October, 1920.

### TREE NURSERY.

A portion of the Testing Station at Kut has been taken over to form a tree nursery. Half an acre was cultivated and made into nursery beds 6 ft. by 15 ft. and slightly raised above the ordinary level of the ground. River silt was spread over the surface of each bed to a thickness of 2 inches to give a fine uncrackable surface. All the seeds were sown in rows a foot apart and about 2 inches deep with the following exceptions—four beds of Indian Ash were broadcasted on the beds and then river silt was added to a thickness of 2 inches. The following sowings were made:—

1. Australian Gum Nuts	..	..	9th April, 1920.
2. Terminalia	..	..	9th April, 1920.
3. Indian Ash	..	..	11th April, 1920.
4. Acacia Catechu	..	..	13th April, 1920.
5. Casuarina	..	..	15th April, 1920.
6. Dodonea	..	..	15th April, 1920.
7. Babool	..	..	23rd May, 1920.

The first sowings of Terminalia, Indian Ash, Acacia Catechu and Casuarina failed to germinate. The reason for this may be put down to the presence of an excessive amount of sandy river silt on the surface of the beds which would not retain the moisture to facilitate germination. The river silt should be carefully mixed with the soil before sowing.

The Dodonea and Babool germinated evenly and the trees were successfully carried through the summer by hand watering.

The following trees have been transplanted along canal banks:—

Dodonea	..	100	Babool	..	100
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Five thousand Babool trees still remain in the nursery ready for transplanting.

### GENERAL REMARKS.

The saifi crop on the Testing Station failed inasmuch as no results of statistical value were obtained. The adverse circumstances experienced were due to:—

- (1) Complete break-down of water supply at the most critical period of the "saifi" crop.
- (2) The Testing Station was not opened early enough in the season for the saifi thus causing late sowing.
- (3) Lack of provision of early and adequate wind screens for cotton and tree nursery.

The cultivation throughout was good and the experience gained by the Cultivators in the initial and intercultivation of cotton also in the use of the modern plough is a slight compensation for being unable to reap a harvest.

## WHEAT EXPERIMENTAL VARIETAL TEST.

The area for the test was divided into 30 1/20 acre plots. Six varieties of wheat were sown—each duplicated five times on the “ chess board system ” and receiving uniform treatment.

VARIETIES.	ORIGIN.
1. Punjab 15	Imported from Punjab, 1918.
2. Punjab 11	” ” ”
3. A. 113	” ” C.P., 1919.”
4. A. 8.	” ” Punjab, 1919.
5. B. h. }	
6. Cross 3. }	

The land was irrigated and then ploughed with the Monsoon Ploughs and immediately boarded down to retain the moisture. It was then cross ploughed and double harrowed which gave a very fine seed bed. Plotting was completed on 10th November, 1920.

Date of Sowing.—15th November, 1920.

Seed rate.—80 lbs. per acre.

Date of germination.—28th November, 1920.

With the exception of three plots in which ants had carried the seed into heaps the wheat came up very evenly. Birds did a little damage at the period of germination and cultivators had to be employed to watch over the plots.

The general progress of the crop has been very good and useful results are anticipated from this test.

The wheat was irrigated as follows:—

November 15th.—Initial Irrigation.

” 28th.—Second Irrigation.

December —Rainfall sufficient.

January 28th.—Third Irrigation.

## COMMERCIAL WHEAT.

The following varieties have been sown with the idea of preserving pure seed for distribution next year.

(a) Punjab II—3 acres.

This area was ploughed, cross ploughed with the Sabool ploughs and double harrowed. The seed was broadcasted at the rate of 80 lbs. per acre. The sowing took place on two separate dates—

28th November, 1920.—2 acres.

10th December, 1920.—1 acre.

The germination has been very good and even and the crop promises well.

(b) Wheat variety A 113.—3 acres.

This area was ploughed, cross ploughed with the Sabool ploughs, harrowed and boarded.

The seed broadcasted at the rate of 80 lbs. per acre.

Date of sowing.—3rd January, 1921.

An even germination was observed on 20th January, 1921, since which date growth has been most rapid. It has every appearance of making a good crop.

(c) Wheat Jassaniyah.—1 acre.

Jassaniyah wheat is locally known as the best ‘Iraq wheat grown in the Kut district. The seed was broadcasted at the rate of 80 lbs. per acre and ploughed in with the local Arab plough.

Date of sowing.—11th December, 1920.

The germination was exceptionally good and the crop is making excellent progress.

## FLAX.

The area brought under cultivation for this crop was 4 acres. Of this area 2 acres had been under cotton during the previous summer and 2 acres had not been cultivated since 1914. One half acre previously under cotton and which appeared slightly salty received stable manure at the rate of 10 tons per acre.

The 2 acres previously under cotton were ploughed with the Sabool plough and double harrowed. Stable manure was applied at the rate of 10 tons per acre on one half acre plot, this being again harrowed.



The remaining 2 acres had not been cultivated since 1914. The area was irrigated and then ploughed with the Sabool plough and boarded down. It was re-ploughed and double harrowed prior to sowing.

Date of sowing.—10th February, 1921.

Seed rate.—153 lbs. per acre.

The seed was broadcasted and lightly harrowed in.

An initial irrigation was applied immediately after sowing—

1st Irrigation A.—11th February, 1921.

" " B.—6th February, 1921.

2nd " A.—26th February, 1921.

" " B.—28th February, 1921.

Heavy rain fell on the night of 15th/16th February, 1921, greatly assisting irrigation.

Date of germination A.—19th February, 1921.

" " B.—23rd February, 1921.

The germination was good throughout the 4 acres and promises to make a good crop. The half acre manured shows a much more rapid growth than the remainder.

#### BERSEEM.

One acre of land which had previously grown cotton was ploughed and cross ploughed with the Sabool plough and then double harrowed. This area was plotted into 1/40 acre plots. The method of sowing adopted was to flood the plots and then broadcast the seed on individual plots as the water receded. Sowing commenced on 20th October, 1920, and it was intended to sow five plots every fourteen days, but owing to trouble experienced with the new pumping set it was impossible to regulate the interval between the first and second sowings.

The sowings were as follows:—

1st Series, 5 plots.—20th October, 1920.

2nd Series, 5 plots.—14th November, 1920.

3rd Series, 5 plots.—28th November, 1920.

The first series germinated well (23rd October, 1920), but required water at the time the pump was broken down and the result was that the best results were not obtained from the plots. The second and third series did not germinate—due largely to the fact that the end of November is too late to sow Berseem and the severe cold nights experienced did not facilitate germination.

#### TREE NURSERY.

The tree nursery was extended to 1½ acres during the Autumn, 1920.

The following sowings have been made—11th February, 1921.

Casuarina	..	..	..	2 beds.
Indian Ash	..	..	..	2 "
Terminalia	..	..	..	2 "
Delbergia Sissoo	..	..	..	2 "

One bed of each variety received a dressing of well rotted stable manure.

100 Babool and 100 Dodonea have been transplanted from the nursery along the banks of the main feeder canal at 3 yards interval.

#### GENERAL REMARKS.

Three months' leave in U.K. having been sanctioned by His Excellency the High Commissioner, I am shortly handing over charge of the Lower Tigris Circle to Mr. E. A. Kinch, Assistant to Agricultural Circle Officer, who will officiate during my absence.

I wish to take this opportunity in expressing my appreciation of the excellent work done by Mr. E. A. Kinch during the period he has been with me as Assistant Agricultural Circle Officer and I have every confidence that the Agricultural work in the Lower Tigris Circle will be progressive under his charge.

I also wish to bring to your notice the valuable work done by Abdul Karim bin Hamdi, Arab Assistant and Mr. V. R. Ghaisas, Clerk, both of whom have served in the Lower Tigris Circle since 1918.

Mr. Avedis Boyadjian, Manager of the Testing Station, Kut, willingly and efficiently carried out his duties although confronted by many difficulties and experiencing disheartening results owing to unforeseen circumstances.

W. D. GARBUTT,

*Agricultural Circle Officer, Lower Tigris, Kut.*

KUT,

4th March, 1921.

## APPENDIX V.

## Administration Report of the Agricultural Circle Officer, Upper Tigris.

On April 1st, 1920, I was appointed A.C.O., Mosul, taking over charge of the Mosul Circle from Lt.-Col. J. M. Birch, D.S.O., who left on 2nd April, 1920, and took with him Pte. Hunt, Agricultural Assistant and his clerk, Pte. Dowsing was transferred to Customs on 23rd March, 1920.

## STAFF.

I was appointed Agricultural Circle Officer with the following Establishment on 1st April, 1920:—

Agricultural Assistant.—Mr. Sabri Anwar.

Clerk.—Mr. Rajaratnam.

Arab Assistant.—Saiyid Djima.

Mr. Anwar was appointed as Agricultural Assistant on 23rd March, 1920, and was transferred to Baghdad on 22nd June, 1920. Mr. Kinch was temporarily attached to me for the Locust Campaign from 2nd April, 1920, and returned to Baghdad on 20th May, 1920.

The menial establishment consisted of—

1 Arab peon.

1 Arab sweeper.

1 Arab bullock driver.

## RAINFALL.

The first rain was experienced towards the end of January which was rather exceptionally late and caused no little anxiety amongst the Daim cultivators. Three inches of snow fell in February. Total readings of rain gauge for the year was 113.12 mm. Highest temperature 111.4°F. and Lowest 18.8°F.

## CULTURAL OPERATIONS.

With the exception of cotton, maize, great millet and rice, mostly daim cultivation is practised throughout the wilayet.

## GENERAL PROGRESS OF SOWING.

Wheat is sown from beginning of November to end of January. Cotton in April and May, maize and millet in May, June and July.

## CONDITION OF PRINCIPAL CROP.

Wheat yielded exceptionally well in Arbil district and we had a good season throughout the wilayet generally. Cotton having been attacked by locusts had to be resown and in consequence yielded poorly.

## HARVESTING OF PRINCIPAL CROPS.

Wheat is harvested during the months of May, June and July, Cotton August and September and Millet November.

## DAMAGE DUE TO PESTS, DISEASES AND FLOODS.

Locusts did an immense amount of damage to cotton and vegetable crops during the months of April and May. The sun pest of wheat was plentiful in Sahaji and Bahutma and reduced the wheat yields there considerably.

## DEPARTMENTAL AGRICULTURAL TESTING STATION.

Cotton Testing Station at Shergat was wiped out by locusts on 11th April, 1920, and was closed down on 19th April, 1920.



## CROP RECORDS.

Results not received from Baghdad in this office.

## TREE NURSERY.

Is being started, following seeds are being planted:—*Robinia*, *Pseudacacia*, *Cedra toona*, *Grevia tiliaefolia*, *Pinus cassia*, *Casuarina*, *Dalbergia sissoo*.

## MISCELLANEOUS.

I arrived in Mosul about the middle of March and took over from Colonel Birch, former A.C.O., on April 1st, 1920.

A small Testing Station was started at Shergat and six varieties of cotton were sown. This Station had to be closed down however on account of locusts towards beginning of May.

I spent most of April combating the locusts in conjunction with other circle officers and Dy. Director of Agriculture in the vicinity of Quiyarah.

During May and part of June touring commenced and metre tests were taken of the 1st, 2nd and 3rd classes wheats and barleys of various districts and forwarded to Baghdad. Towards latter part of June, touring became a little difficult owing to the unsettled nature of the country. I spent July in touring Arbil and Dohuk districts. The remaining months were spent in touring, and towards the end of December a consignment of monsoon ploughs arrived up from Baghdad. These were demonstrated and sold to local cultivators. Afterwards I made an inquiry into the economics of sheep and have made a few notes on same, which will possibly be published in the Agricultural Journal later. Most of last month was spent in Baghdad, where I took six large Mosul farmers down to see the tractor trials.

ROSS R. ANSON,

*Agricultural Circle Officer.*

MOSUL:

*March, 1921.*

## APPENDIX VI.

## Administration Report of Agricultural Officer, Euphrates Circle.

In July, 1920, I took over the Circle from Captain V. H. W. Dowson on his leaving for England on leave. It was most highly disappointing that I had to leave the headquarters at Museyib within two days of my taking over owing to the advance of the insurgents. I left Museyib with the Political Officer.

From that time onwards it was impossible to get about the District and it was therefore closed down.

When I visited Museyib some three months later, the Testing Station was completely dried up, and the experiments that had been started on groundnuts and cotton were quite valueless. Indeed so little cotton remained that it was not worth while to pick it.

Work at the testing station at Hillah was effected in the same way and the farm had to be closed down. From the 12th July to the 14th October, the farm was abandoned, and during this period the cotton and groundnut experiments had no irrigation, and no attention of any kind. Thus no result of any value was obtained.

However as the cotton crop received such exceptional treatment it may be of interest to briefly record what was done.

The experimental station consisted of 6 acres of land just to the north of Hillah Town. Of this 3 acres was devoted to cotton experiments.

Preparatory to the cotton, *Berseem* had been grown followed by a manuring, particular care being taken to spread the manure evenly.

Preliminary cultivation commenced in January, the land being ploughed, and cross ploughed followed by a boarding. The ridging was done by hand, the distances between the ridges varying with American and Egyptian varieties, being 3 ft. 6 ins. and 2 ft. 6 ins. apart respectively.

The scheme was to discover the variety best suited to the District, four Indo-Americans and two varieties of Egyptian Cotton were sown in series 1/10th acre plots duplicated 5 times. The varieties were *Triumph*, *Webber 49*, *Allen's Long Staple*, *Punjab 285 F.*, *Sakellarides* and *Ashmouni*.

Ten plots, namely, A1, A2, A3, A4, A5, A6, B1, B2, B3, B4, were irrigated before and after sowing. The remainder did not receive an irrigation immediately after sowing though this was found necessary 9 days later.

The temperature generally was rather higher than the previous year, and very hot north winds blew during the hottest parts of the year. It was particularly noticeable during June and July that the American varieties could withstand these hot winds better than the Egyptians.

The following is a brief description of the state of the different varieties before evacuation and after:—

Variety.	Number of Irrigations.	Description before evacuation.	Description after evacuation.
<i>Triumph</i> ...	4	Moderate height, luxuriant growth, very healthy with large number of flowers and bolls.	Still had flowers on but very much dried up.
<i>Webber 49</i> ...	4	Growth rather stunted but with good number of flowers and bolls.	No flowers remaining and growth stunted.
<i>Allen's long Staple</i> ...	4	Moderate height, flowered early, fair number of bolls.	Still had flowers but very dried up.



Variety.	Number of Irrigations.	Description before evacuation.	Description after evacuation.
<i>Sakellarides</i> ...	5	Good growth but fewer flowers and bolls than usual.	A few flowers left but very much dried up, only a few leaves remaining at the top of the plant.
<i>Ashmoun</i> ...	5	Even growth, large number of flowers and bolls.	No flowers remaining, all plants absolutely dried up, nothing but the stalks remaining.
<i>Punjab 285 F.</i> ...	4	Excellent growth, more bolls than the others.	Condition good, looking almost like a plant that had received normal treatment. Unopened bolls and flowers were still on the plants. In this case most of the cotton was picked off the plants and not from the ground.

Practically all the Cotton except in the case of *Punjab 285 F.* was picked off the ground and was very dirty. All cotton was noticed to be weak in the lint.

The *Sun-hemp* was in flower, looking very healthy, and the average height was nearly 12 ft. This must have formed a most efficient wind break during the time the farm was abandoned and must have helped considerably in protecting the cotton from the hot winds that occurred.

Everything else that had been growing was completely dried up such as Sugarcane, Artishokes, Groundnuts, Castor Oil.

The total amount of cotton picked was approximately 900 lbs. but probably a quantity had been removed by the Arabs.

#### PESTS.

Grasshoppers, Caterpillars and Red Spider were found in most of the American varieties and did a good deal of damage to the young plants.

On returning to the farm in October no boll worms were noticed.

It was very disappointing that the year's work at the Testing Station was of no value, particularly so to Mr. R. D. Menon who had put in so much work on it.

C. L. WHITE,

*Formerly Agricultural Circle Officer, Euphrates.*

*April, 1921.*

## APPENDIX VII.

# Report of the Superintendent, Central Farm, Rustum (Baghdad).

## STAFF.

Names.	Date of appointment or transfer.	Post.
<i>Gazetted—</i>		
C. L. White, Esq. ...	15th October 1920, ...	Superintendent.
<i>Non-gazetted—</i>		
Mr. Gopal Singh ...	15th October „ ...	Asst. Manager.
„ R. D. Menon ...	24th November „ ...	Manager Estate.
„ L. V. Ghate ...	11th December „ ...	Asst. Manager.
„ Ghulam Haider ...	12th „ „ ...	„ „
„ Khalil Ibrahim ...	.....	Fieldman.
„ Sayid Ibrahim ...	November „ ...	„
„ Harnam Singh ...	„ „ ...	Clerk.

## GENERAL.

I took charge of the Rustum Experimental Station on October 15th, 1920, when work was started with fifteen men transferred from the Cotton Farm. The Farm had, prior to this, been practically abandoned for a period of about 4 months owing to the disturbances. Many difficulties were met with at the start, as was to be expected, and this initial delay has meant working against time ever since. The main difficulty has been labour, work was started at a time of the year when labourers were mostly already engaged. A considerable proportion of the labour it was possible to obtain was very far from good.

Until the end of October practically nothing had been done beyond the digging of the main canals over about 200 acres and the laying out of a tree nursery some 1½ acres in extent.

The accommodation was very limited indeed, the staff mainly living in tents, while considerable time and labour had at first to be given to the erecting of houses for the fellahs, Stores, Stables, etc.

## CULTIVATION.

The main operation up to the end of the year was ploughing, 230 acres being completed in the time. Great difficulty was at first experienced with the mules getting rubbed with the continuous work on hard ground which was full of shok roots. It was impossible to irrigate the land previous to ploughing owing to the engine being out of order, and the fact that only the main canals had been dug which were far too big for the small temporary engine.

The mules settled down to the work fairly soon and comparatively little trouble was experienced in training them.

The bullocks gave considerable trouble and for a long time needed very vigorous coaxing to make them work.

All ploughs used were satisfactory, only a few shares were broken. A Monsoon plough was tried but was too light for the hard ground. The types of ploughs used were Turn Wrest ploughs, Jat ploughs, Sabul ploughs. All the breakages occurred with the Jat ploughs which were rather light for the hard ground but were very useful for use with the bullocks.



A heavy clod crushing board was used over all the land after ploughing but it was soon found to be ineffective except after rain, the ground coming up in such large and hard clods.

Some of the land had to be harrowed after using the clod crushing board. A certain amount of levelling had to be done.

#### SOWING.

Wheat 120 acres was sown consisting of the following varieties:—

A.-113	...	...	...	8 acres.
A.-11	...	...	...	48 "
P.-15	...	...	...	55 "
B.-8	...	...	...	2 "
A.-8	...	...	...	2 "
X.-3	...	...	...	2 "

Of this twenty acres of *Punjab II* and 20 acres of *Punjab 15* was sown Daim at the beginning of the new year.

#### BARLEY.

Thirty acres was sown, about 20 acres of which was Daim. It is hoped to be able to give all this Daim corn one irrigation before harvest.

The sowing was somewhat hurried to take advantage of the rains and the majority of the minor canalisation had to be done later. Small quantities of Californian and Chilean Barleys were sown. The wheat varietal tests were laid out and sowing took place just after the new year. Two other experiments were laid down for the Deputy Director of Agriculture, Research, the Smut control experiment and the Nutrient Solution test.

#### TRACTORS.

The following tractors did a certain amount of work in preparation for the tractor trials, the Austin, Fordson and the Fiat. It was interesting to note how soon the native drivers become quite expert.

#### CONDITION OF ANIMALS.

The animals arrived at the farm from Baghdad in bad condition but in spite of working daily for long hours on hard ground their condition at the end of the year was very satisfactory. Unluckily one mule had to be shot on account of Epizootic Lymphangitis which necessitated considerable trouble in disinfecting and digging stables, etc., but no further case occurred.

#### CANALIZATION.

This occupied more labour and time than anything else. All the baulks of the main canals already dug had to be made up although these canals were quite useless for their purpose owing to there being only the small powered temporary engine.

This necessitated making a complete system of canalization from this engine including a long high level canal.

#### ENGINE.

A great deal of trouble was experienced in getting the engine in order after re-erection but once this was overcome the engine gave no trouble.

#### TREE NURSERY.

Owing to lack of water for a number of months after being sown the plants that come up were very small when very severe frosts caught them and all plants were killed.

#### CONDITION OF CROPS.

All corn sown germinated well and considering that the seed had been broadcasted the germination was very even.

## FODDER SUPPLY.

Tibben has been all the time very difficult to obtain. The animals have badly wanted a change to green food but this has been impossible.

## RAINFALL AND IRRIGATION.

The rainfall has not been evenly distributed, a considerable amount fell towards the end of December but before and after that for long periods none or very little fell. The effect was that where the rain fell after wheat had been sown a hard crust was formed which made it difficult for the plants to force their way through.

## IRRIGATION.

A considerable number of breaks in the canal banks and small bunds occurred especially when irrigating for the first time or when irrigating at night.

## TEMPERATURE AND ITS EFFECTS.

A week of very sharp frosts occurred in November killing practically all the young trees in the nursery. In spite of severe frosts occurring shortly after irrigating some of the wheat, no damage was done.

## PESTS AND DISEASES.

No diseases were noticed.

## MISCELLANEOUS.

I would like to take this opportunity of expressing my indebtedness to all Assistants who worked hard and well in spite of many discomforts. The very small amount of accommodation available, leaked very badly indeed and was far worse than the tents provided. I would particularly like to mention the valuable and consistent work done by Mr. Gopal Singh who was largely responsible for managing the labour with its host of petty troubles when starting in a new place.

C. L. WHITE,  
*Superintendent, Central Farm, Rustum.*

*12th March, 1921.*





## APPENDIX VIII.

### Report of the Cotton Expert.

#### I.—COTTON FARM, KARRADAH.

##### 1.—THE SEASON.

The Meteorological data recorded by the Weather Bureau in Baghdad are summarised in the subjoined statement.

It may be noted that the total rainfall for the year was 7.70 inches as compared with an average of 6.67 inches for the previous thirty-two years. The distribution of rainfall through the year was normal. The mean maximum temperatures were appreciably lower than the averages for the previous thirty years; but the mean minimum temperatures were about normal with the exception of those of February and December, during which months sharp frosts were recorded for a few days in succession.

##### STATEMENT I.

##### *Meteorological Records at Baghdad.*

Month.	Mean Rainfall in inches:		TEMPERATURE IN F°				Relative Humidity.	
			Mean Maximum.		Mean Minimum.			
	1887-1919	1920	1888-1919	1920	1888-1919	1920	1889-1919	1920
January ...	1'21	0'05	59'2	58'7	38'8	40'2	79	79
February ...	1'10	1'50	65'2	55'6	43'2	37'9	74	71
March ...	1'19	2'57	72'8	72'0	49'4	52'7	69	76
April ...	0'80	0'60	82'7	85'2	58'2	59'9	60	54
May ...	0'23	0'06	93'9	95'5	68'1	70'4	50	40
June ...	...	...	104'2	105'1	75'8	78'1	37	27
July ...	...	...	109'4	105'4	79'5	79'7	37	29
August ...	0'02	...	113'4	108'9	78'6	78'3	40	29
September ...	...	0'18	103'5	101'0	72'5	72'9	42	34
October ...	0'08	0'36	92'4	93'8	63'1	66'2	51	45
November ...	0'90	0'38	75'2	70'8	50'7	48'2	66	63
December ...	1'23	2'00	66'3	58'1	45'3	37'7	79	70
	6'76	7'70	86'5	84'2	60'3	60'2	57	52
	TOTALS.		MEAN ANNUAL.					

##### 2.—EXPERIMENTS.

##### A.—VARIETAL TEST.

As in the two previous seasons the main experiment was the Varietal Test which was designed to discover the variety of cotton best suited to the local conditions. Of the twelve varieties cultivated in 1919, *Punjab 4 F*, *Black Rattler* and *Turk* were discarded; whereas the varieties named *Sudan*, *Nyasaland*, *Sak-Sudan*, *Sunflower* and “*Local*” were included in the Test for the first time.

The same system of experimenting was adopted as in the previous seasons. The individual plots were 1/20 acre in size and about three times as long as they were broad. Each variety was replicated in six series. Data relating to those plots which gave exorbitantly high or low yields have been excluded from Statement II.



STATEMENT II.  
Consolidated data recorded at the Cotton Farm, Baghdad, in 1919 and 1920 with seventeen varieties of Cotton.

Name of Variety.	Type of Cotton.	YIELD PER ACRE.						Ginning Percentage.		REMARKS.	
		Average Number Waterings.*		SEED COTTON.		RAW COTTON.					
		1919.	1920.	1919.	1920.	Average.	1919.	1920.	Average.		1919.
Allen's Staple	...	13	13	Lbs. 2091	Lbs. 1109	Lbs. 554	Lbs. 286	Lbs. 420	26.5	25.8	Discarded after the 1919 Experiments.
Ashmouni	...	14 $\frac{3}{4}$	14 $\frac{1}{2}$	1908	955	603	279	441	31.6	29.2	
Assili (Afffi)	...	14 $\frac{3}{4}$	14 $\frac{3}{4}$	1387	700	405	204	304	29.2	29.1	
Cawnpore 9	...	13 $\frac{3}{4}$	13	2344	1566	696	445	570	29.7	28.4	Grown for the first time in the 1920 Experiments.
" 18	...	14 $\frac{3}{4}$	13 $\frac{1}{2}$	2530	1809	779	535	657	30.8	29.6	
Punjab 285 F.	...	13 $\frac{1}{2}$	13	2610	1559	754	447	600	28.9	28.7	
Sakel ...	...	14	14 $\frac{1}{2}$	1698	590	465	144	304	27.4	24.4	
Triumph	...	13	13	2068	1314	672	424	548	32.5	32.3	
Webber 49, (Mespot White).	...	13	13 $\frac{1}{2}$	2072	1530	570	414	492	27.5	27.1	
Black Rattler	...	13 $\frac{3}{4}$	...	2046	...	607	...	...	29.4	...	
Punjab, 4 F.	...	14 $\frac{1}{2}$	...	2807	...	873	...	...	31.1	...	
Turk ...	...	14	...	1339	...	390	...	...	29.1	...	
Local ...	...	...	14 $\frac{1}{2}$	...	1237	...	249	...	...	20.0	
Nyassaland	...	...	13	...	1617	...	409	...	...	25.5	
Sak-Sudan	...	...	14 $\frac{3}{4}$	...	1100	...	279	...	...	25.4	
Sudan...	...	...	13 $\frac{3}{4}$	...	1663	...	453	...	...	27.2	
Sunflower	...	...	13	...	1277	...	295	...	...	23.1	

\* Inclusive of initial Irrigation to discover the waterline.

All plots were sown in season during April. No serious difficulties were encountered with the water supply. Previous experience had shown that to water individual plots when they *appeared* to require water led to irregularities which could be obviated by introducing a system of rotational irrigation. An initial watering was given to find the water level on each ridge; the seed was sown as soon as the soil permitted; and a second watering was given immediately afterwards. Subsequent waterings were given at intervals of 35, 20, 15, 12, 10, 10, etc., days until the end of the first week in October, to all varieties of American type, and at intervals of 8 or 9 days during the hot season to varieties of Egyptian type.

All plots were intercultivated by hand-labour three times. The picking season commenced in the middle of July—about a fortnight earlier than the previous year. The yield of seed-cotton of every variety was appreciably lower than in 1919. This is attributed to the sterility of the soil consequent upon continuous cropping and inadequate manuring.

Very considerable differences in yield were recorded in plots treated in as identical a manner as is practicable under field conditions. These differences are in some cases so great as to vitiate the value of the data.

As a result of the experimental work undertaken during 1918 and 1919 the belief was expressed, with reservation, that of the varieties under experiment *Webber 49* showed greatest promise. The relatively high yield obtained in previous years with this variety has been maintained. This fact coupled with the excellence of its staple indicate the suitability of *Webber 49* for cultivation in Mesopotamia. In 1918 the available seed of *Webber* was about 1½ lbs. only. In 1920 about 100 acres were grown under this crop, and for 1921 there is enough seed on hand to sow about 2,000 acres. It has now been definitely decided to confine seed distribution amongst cultivators to this variety only until such time as another variety may prove superior to it.

In view of the fact that cotton from *Webber 49* grown in Mesopotamia possesses certain intrinsic qualities not commonly associated with American cotton, it has been decided to give this cotton the commercial name of *Mesopot White*.

The Liverpool valuations of the varieties grown in 1920 are not yet to hand, so that it is not possible to include in Statement II the relative value of each variety.

#### (b) OTHER EXPERIMENTS.

The remaining experiments included—

- (a) Optimum Date-of-Sowing with *Webber 49* and *Ashmouni*.
- (b) Irrigation Experiment—to discover the earliest date by which watering of the cotton crop could be economically discontinued.
- (c) Spacing Experiment with *Webber 49* and *Ashmouni*.
- (d) Flat *versus* Ridge system of sowing cotton.
- (e) A Varietal Test with twenty-three strains of cotton selected from single plants in 1918.

Owing to the abnormal variations in soil fertility in plots treated identically in the above experiments the data collected are too unreliable to draw conclusions of any value. An attempt is being made in 1921 to overcome, at least in part, this difficulty of soil variation by making the plant, and not the plot, the unit of yield. For this purpose observation rows of 100 to 200 even-sized plants will be selected in each plot and separate records maintained for these selected rows.

The selection of superior strains of cotton from single plants, and the propagation of those hitherto selected were continued. A commencement was made with the cross-fertilisation of different varieties of cotton with the view to rearing plants which combine such desirable characters as heavy yield and long staple. Noticeable features of the very heavy-yielding varieties of cotton under experiment, such as *Punjab 285 F* and *Cawnpore 18* are the profusion of fruiting (or monopodial) branches borne by each plant, and the elasticity of the branches. *Webber 49* lacks in both of these qualities. An attempt is being made to impart these desirable characters to *Webber 49* without materially impairing the quality of its staple.

### 3.—DISTRICT WORK.

#### (a) EXPERIMENTAL FARMS.

Six of those varieties of cotton which had excelled at the Cotton Farm, Baghdad, during the previous two seasons were distributed for further tests at four out-stations, namely:—Ba'qubah, Hillah, Kut and Shergat. Early in the season these varietal tests on all four farms showed every promise of giving

results of real value. The germination was good throughout, and growth in individual plots was even. The history of the work on these farms for the remainder of the season, though, perhaps, of no scientific value, is worthy of record as indicative of the conditions under which the work is being conducted. The tale is one of disaster. The crop at Shergat was completely eaten up by locusts; that at Kut suffered from severe drought owing to the irrigation plant breaking down and the crop was abandoned; the Ba'qubah Farm was looted by rebels during the disturbances and the cotton crop pilfered; at the Hillah Farm, the attacking rebels found good cover in the cotton-crop with the result that the farm was under shell-fire from our guns for some months. Another attempt is being made in the current year to conduct these varietal tests on three out-stations.

#### (b) TEL DEIR COTTON ESTATE.

In order to acquire a true perspective of the work done on the Tel Deir Cotton Estate in 1920, it is, perhaps, as well to summarise briefly the general programme of Cotton Improvement Work originally projected in Mesopotamia. This comprised the cultivation in small plots of a large number of varieties of cotton imported from the various cotton-growing countries of the world with the view to discovering the variety best suited for cultivation in the country. Having discovered this variety it remained to demonstrate what profits, if any, could normally be expected from its cultivation. The nature of the work involved, however, is entirely different from that of experimental cultivation in small plots. Besides, it is well to bear in mind that the financial statement concerned with the cultivation of any crop grown on a commercial scale by Government agency is, normally, of considerably less value than when undertaken by private agency.

Conditions were such in 1920 that no private agency could undertake the work in time for the 1920 cotton season. It was most important that this preliminary effort to cultivate cotton on a commercial basis should be undertaken during the year. In addition to the financial aspect of cotton cultivation there were involved two important issues, namely: the propagation of the seed of that variety which showed greatest promise, and the demonstration of approved methods of cotton cultivation. The work had, therefore, of necessity, to be undertaken by the Agricultural Directorate.

Owing to the abnormal conditions obtaining in Mesopotamia in the Summer of 1920 the financial aspect of this preliminary effort to cultivate cotton in bulk, though of interest, loses much of its value. In so far as propagation of seed and demonstration of approved methods of culture are concerned, the necessary ends have been attained.

#### SITE.

The Tel Deir Cotton Estate was situated some 25 miles due South of Baghdad about 3 miles West of the Baghdad-Hillah Railway. The site was Government property irrigated by a Government canal. The land was irrigated by a distributary of the Yusufiyah Canal (taking off from the Euphrates) constructed as a Military necessity during the War to increase the production of cereals. Remains of ancient canal-banks are scattered all over the country in this locality. Previous to the construction of the Yusufiyah Canal the Arab tribe located in this tract had been almost purely pastoral in its customs, and the land had been uncropped probably for centuries except for the crop of cereals grown in 1919. The soil was a rich alluvial loam of unknown depth and free from salt. The land had received no manure.

#### SHARE SYSTEM.

It being confidently believed that the cultivation of cotton on a commercial scale by casual, or daily-paid, labour is not a practical proposition in Mesopotamia, it was decided to grow the crop on the Tel Deir Estate on the Share system. The Government Revenue share on Government owned lands under the Yusufiyah Canal is 30 per cent. of the gross yield. The cultivators agreed to accept as their share 40 per cent. together with the cotton stalks remaining on the land at the end of the season. The Sheikh was offered 5 per cent.; and the Agricultural Directorate, functioning as Capitalist, reserved a claim on the remaining 25 per cent.

It was originally proposed to cultivate 200 acres on this system; but for various reasons it was found impracticable to control more than 80 acres. This area was divided into blocks each measuring  $6\frac{1}{4}$  acres (being one-half of the local unit of one feddan). A headman was selected for each block and all transactions were conducted direct with these headmen. The Shaikh undertook to supply the necessary labour. Conditions of contract were drawn up and Arabic translations issued to each headman and the Shaikh. These conditions included *inter alia* an advance payment of Rs. 50 per mensem to each headman



to meet his current expenses, strict adherence to the system of cultivation recommended, the shares to which each party was entitled, penalties for theft, and a statement to the effect that the value of the cotton at the end of the season would be assessed by the Cotton Expert on the basis of local prices, Bombay price or Liverpool price—whichever was the more advantageous to the cultivator.

#### STAFF.

Until the beginning of July the supervision of the work was entrusted to Mr. W. Allen. On his relinquishing his appointment in the Civil Administration he was replaced by Mr. Ghulam Hussain, one of the Indian College-trained Assistants who had been engaged on experimental work with me during the previous two seasons. Two specially imported Egyptian cultivators were detailed to initiate the Arab cultivators in the method of cultivation.

On the outbreak of disturbances towards the end of July the staff was recalled to headquarters in Baghdad. Mr. Ghulam Hussain paid two subsequent visits on horseback to the Estate. On his last visit he was shot at by a neighbouring tribesman. The majority of the cultivators on this canal were now proscribed rebels and further visits of inspection were discontinued. Touch was however maintained with the progress of the work by arranging with some of the headmen of the cotton blocks to visit me in Baghdad periodically. Mr. Ghulam Hussain visited the estate again at the end of the season when the rebellion had been quelled. Practically the whole of the Government property and of personal effects of the staff, which had been entrusted to the charge of the Shaikh, were recovered.

No buildings were erected on the Estate. The Shaikh and his tribe lived in their goat-hair tents, and the staff during its period of residence was under canvas.

#### THE SEASON.

A few showers of rain fell between the middle of February and the end of March; these materially assisted the preparatory cultivation of the land. A heavy shower fell on 19th April after the seed had germinated. The remainder of the season was rainless as is customary in this country. The maximum day-temperatures recorded from June to October at the Cotton Farm, Baghdad, varied from 90 deg. F. to 120 deg. F.

#### SOWING.

During the period that lapsed between the time that the Shaikh agreed to undertake this work in December and the preparatory cultivation of the land at the end of January, it appears that he changed his views on the contract into which he had entered. Without reference to the Agricultural Directorate he ploughed the land which he had agreed to reserve for cotton, and sowed it with wheat. The wheat crop had just germinated when I next visited the Estate. The Assistant Political Officer, Museyib (Captain J. O'Sullivan), was asked to arbitrate in the matter, and the Shaikh agreed to plough up his wheat crop on compensation being paid to him for the value of the wheat seed sown. This was done and the land was again ploughed twice preparatory for the cotton crop.

Ridging commenced on 11th March and was completed on 21st. The country plough was used for this purpose, and the ridges were finished off with the *mirazu* (push-rake) and shovel.

The variety of cotton grown was one that has been given the commercial name *Mesopot White*. It is the type, grown experimentally under the name *Webber 49*, which originated from the Pedigree Seed Company S. Carolina, U.S.A. The sowing was completed by 3rd April.

The seed germinated well. The seedlings were thinned to two in each hill in May. As the season advanced it became apparent that a fair number of crosses with Egyptian varieties were present. These were obviously the results of growing the *Webber* variety in close proximity to the Egyptian varieties in experimental plots during the previous two seasons. All of these crosses were "rogued"—with perhaps, a little difficulty, as the Arabs failed to appreciate the motive.

#### \* IRRIGATION.

An initial watering was given to discover the water-line on each ridge. Another watering was given immediately after sowing. The next waterings were given after intervals of 40, 20, 12, 12, etc., days until the end of July when the Supervising Staff was recalled. Watering should have been continued at 12 days intervals until the day of September, but from the outbreak of the Arab

Rebellion in July until the end of the season the control of the Yusufiyah Canal was in the hands of the rebels; the irrigation staff had also been recalled; and control over the rotational distribution of water had been completely lost. The cotton crop appears to have received its last watering in the middle of August.

#### INTERCULTIVATION.

The whole of the crop was intercultivated three times by manual labour with the fass and shovel. The hot winds which prevailed during a part of June and July caused many flowers and young bolls to shed. The windscreen of castor plants grown around the Estate and also between adjacent blocks is believed to have afforded a certain amount of protection from these winds. There was a conspicuous absence of weeds.

#### HARVEST.

The first picking of cotton was taken on 15th August. From this date the crop was picked at short intervals as labour became available. On 26th October, the Superintendent who visited the estate on that date reports that the plants were devoid of any green vegetation and the land was thoroughly dry. Arrangements had been made to supply each headman with his requirements of *shileefs* for storing and transporting his cotton. Each of these *shileefs* was comprised of three gunny-bags split and the edges sewn together. The supplying of *shileefs* presented difficulties when it was discovered that these cotton cultivators were proscribed rebels and were forbidden to enter Baghdad. On enquiry it was found that by devious means they delivered their crop of vegetables daily in the Baghdad Market. Their rendezvous was ascertained and arrangements made with their representative to transport the *shileefs* to the Cotton Estate. The picking of the crop was completed in September whereas the normal picking season extends into December. It was deemed advisable to take delivery of the cotton as early as possible, but for political reasons payment had to be deferred on the score that the money paid to the cultivators might be used for purchasing more rifles. The Political authorities concerned agreed that payment might be made to the cultivators for their share of the crop on the expiry of one month after the date of delivery of the cotton. The reason for thus deferring payment was that an attack had been arranged on the neighbouring insurgents who had been very troublesome to our line of communications; and the coup was expected to take place within the prescribed month. The cultivators would only agree to this procedure on my giving my word of honour that payment would be made as agreed. They next requested that their camel transport should be immune from attack by aeroplanes when *en route* to Baghdad with the Cotton. This was arranged on consultation with Intelligence Branch, G.H.Q. All the cotton, some four hundred camel loads, was delivered at the ginnery of the British Cotton Growing Association in Baghdad by the end of October.

The seed cotton delivered was exceptionally clean. The quality had suffered as the result of irregular and inadequate irrigation. The total quantity received at the ginnery was 100,000 lbs. of seed cotton: equivalent to 1,250 lbs. per acre. It is firmly believed that the yield would have been appreciably higher had it been possible to continue to irrigate until the end of September as originally proposed. The crop has since been ginned by the British Cotton Growing Association, baled with the assistance of the Mesopotamia-Persia Corporation, and the raw cotton has been shipped to Liverpool to be sold on behalf of the National Government of Mesopotamia.

#### VALUATION OF COTTON.

At the end of October, when the cotton was delivered, the price quoted in Liverpool for Middling American was 15*d.* per pound, and for F. G. F. *Sakellarides* 30*d.* per lb. On this basis *Mesopot White* was arbitrarily estimated by me at 27½*d.* per lb. From this 2½*d.* per lb. were deducted for estimated charges to be incurred on ginning, baling, freight, insurance, etc., and the balance of 25*d.* per lb. was taken as the basis for calculating the shares of the cultivators (40 per cent.) and the Sheikh (5 per cent.). A point of special interest in this connection is the fact that on the basis of 25 *d.* per lb. the cultivator received for 40 per cent. of his crop as much as he would for the *whole* of his crop had he preferred to sell it in the local market at the current price. In other words, on the above basis the Liverpool valuation was slightly more than two and a half times as high as the price in the Baghdad market quoted for any cotton irrespective of grade or quality.

At the time of writing there is a remarkable slump in cotton prices on the world's chief markets. The slump is now at its lowest ebb, and there are already



signs of recovery. It may be argued that the basis adopted for valuing the 1920 crop of *Mesopot White* was not justifiable in the light of the subsequent drop in prices; and that, in consequence, the money paid to each cultivator was exorbitant and did not represent what he could normally expect from cotton cultivation. In answer to such a criticism it is well to remember that fortune favours the brave; and the Sheikh with his cultivators fully deserved their reward. Each cultivator (headman) was paid on an average Rs. 1,000 per block of  $6\frac{1}{4}$  acres; which, at the conversion rate of Rs.  $12\frac{1}{2}$  = £1, is equivalent to £12.8 per acre. This sum represents 40 per cent. of the gross value of the cotton crop, but does not include the value of the cotton stalks as fuel.

#### INCIDENTAL.

The subject of this paragraph, though it does not bear directly on the progress of work on the Tel Deir Estate in 1920 nor on the results obtained, should, nevertheless, be of interest in its demonstration of the psychology and as an illustration of the customs of the Arab—factors which demand deliberate consideration by all who have an interest in his welfare.

After all the cotton had been removed from the plants on the Cotton Estate in the Autumn a shepherd permitted his flock of sheep to browse on the leaves of the cotton plants. The cotton cultivators forbade him to do so; but whether the sheep entered the cotton fields by accident or by design is not known. A fracas ensued between the shepherd and the cultivators. Partisans of both entered the fray with drawn daggers and loaded rifles. Sequel:—Five human corpses. The case was later tried by tribal law and settled amicably on payment of blood-money by the party that had least casualties. It is only fair to mention, however, that this affray was due almost entirely to the general state of unrest prevailing in the country at the time.

#### CONCLUSIONS.

As the result of this initial effort to cultivate cotton on a commercial basis and on the share system with Arab cultivators, it has been possible to collect much valuable information which should be of use to landowners and cultivators in the country; to capitalists who desire to finance cotton cultivation on large estates; and to the Government. The facts elicited may be briefly summarised as follows:—

1. The contention (based on experimental work undertaken during the previous two seasons) that the conditions of soil and climate in Mesopotamia are well suited to the cultivation of cotton of superior grade and quality, has been vindicated. An average yield of 1,250 pounds of seed cotton per acre was harvested on 80 acres. And it is confidently believed that the yield would have been appreciably higher had it been possible to grow the crop under average conditions. This yield compares favourably with the average of 1,200 lbs. per acre in Egypt, 600 lbs. in America and 200 lbs. in India.

2. On the basis of prices ruling on the Liverpool market in October, 1920, namely, 15*d.* per pound for Fully Middling American and 30*d.* per pound for F.G.F. *Sakellarides*, the cultivation of cotton in Mesopotamia can be highly profitable.

3. That the share system of cultivation of cotton on large estates is better suited to the success of the crop than the employment of casual labour paid a daily wage.

4. That with proper guidance, supervision and advice, coupled with considerate treatment, the Arab cultivator in Mesopotamia can successfully cultivate cotton.

5. That Arabs, who until very recently were almost purely nomadic in their habits, take readily to the intensive cultivation of crops where facilities for such are placed at their disposal.

6. That cotton, unlike any other summer crops which are now grown on an extensive scale, provide whole-time occupation to the cultivator and his family throughout the summer months. It is not improbable that the extensive cultivation of cotton may contribute largely towards the peaceful settlement of the Arab population on the land during a period of the year when, normally, their predatory instincts, blood feuds, and tribal raids are most in evidence.

#### C.—OTHER ESTATE CULTIVATION.

It was the considered programme of the Cotton Expert that all distribution of cotton seed to cultivators and estate owners should be deferred until the experimental work started in 1918 had given definite indication as to which variety of cotton should be distributed to the exclusion of all others. There are



in Mesopotamia a number of estate owners who have personal experience of Egyptian cotton. In 1920 three landowners expressed their desire to grow Egyptian cotton and asked permission to import the seed on their own account. In view of this insistent demand for seed and of the risk involved in importing the Pink Boll-Worm of cotton into Mesopotamia with the imported seed it was decided that the Agricultural Department should undertake this work. Ten tons of Ashmouni and 10 tons of Sakel were therefore imported. This seed was fumigated before being despatched from Egypt and again on arrival in Mesopotamia. With the exception of a few tons of Ashmouni this seed was distributed and sown.

It is sad to have to relate that much the same fate befell the efforts of these estate-owners as that experienced on the outlying Government Experimental Farms. Except for the first picking of cotton early in August before the Arab Revolt had become widespread, very little, if any, cotton was harvested. It is, however, firmly believed, that with more considerate treatment of the actual cultivator the outcome would have been more to the advantage of the estate owner. It is significant that the cultivation of cotton on the Tel Deir Estate by cultivators who were proscribed rebels-should have succeeded whereas all three privately-owned estates recorded failures. There was, however, one very marked difference between the system adopted at Tel Deir and that on the other estates referred to. At the former the share system was adopted; the Shaikh and his cultivators had a personal and a pecuniary interest in the crop; and the price offered for the cotton was based on its value in the Liverpool market. The present instance is a concrete illustration of the previously recorded contention that the share system of cultivation on estates is the one that gives the greatest guarantee of success.

In addition to the above seed of Egyptian cotton, some half-dozen different strains of *Webber*, selected in 1918, were distributed to be grown on areas of about one acre with the view to further propagation in the event of any of these strains proving to be of special merit in the varietal tests conducted on the experimental farms. No trace of any of these strains is now available.

#### D.—INSTRUCTION AND DEMONSTRATION.

Six Egyptian cultivators were very kindly selected by the Egyptian Government and deputed to Mesopotamia under the charge of an Agricultural Assistant, Sabri Anwar Effendi. Four of these cultivators were detailed for duty on privately-owned estates with the view to initiating the inexperienced Arab in the technique of the Egyptian method of cultivation. The remaining two cultivators were allotted to the Tel Deir Government Estate.

At the Cotton Farm, Baghdad, a special exposition was held in October when a large number of land-owners, notables and representatives of Commercial Firms attended. The various Officers of the Department took the several parties round the Farm. The subjoined copy of a letter received from the British Chamber of Commerce in Baghdad testifies to the value which its members attaches to the work of the Agricultural Department in general.

*Copy of letter, dated the 7th October, 1920, from the Secretary, British Chamber of Commerce, Baghdad, to the Officiating Director of Agriculture, Mesopotamia.*

“ At a meeting of the Committee of the British Chamber of Commerce held on the 6th instant, I was instructed to write to you expressing the thanks of the members for the extremely interesting exposition given at the Cotton Farm on the 28th ultimo. The Chamber takes this opportunity to express its appreciation of the work of the Department of Agriculture generally and its desire to assist it by any means in its power. It is convinced that the Department will, as time goes on, form a most valuable and, it hopes, lasting bond of union between the inhabitants of the country and British interests generally.”

(Sd.) \_\_\_\_\_

*Secretary.*

#### STAFF.

At the Cotton Farm, Mr. Ahmed Ali Soofi continued in charge of the Management assisted by Mr. Ghulam Hussain, Mr. Gopal Singh, Mr. Khalil Ebrahim and one local fieldman. Messrs. L. V. Ghate, Ghulam Haider, Sadiq Hussain and Shazad Singh reported for duty from India during the year. These latter were temporarily stationed at the Cotton Farm pending the cessation of the Arab revolt.

## PERSONAL.

The year was one of much anxiety at the Cotton Farm. Despite the fact that the Farm is situated about two miles outside the Baghdad defences, the staff, which was at no time provided with a guard, succeeded in carrying out all experiments according to programme. The security and protection which the staff and the Farm enjoyed are mostly to be attributed to the friendliness that existed between the staff and the adjoining land-owners. It is particularly pleasing to be able to record that the experimental work undertaken with cotton during the past three years has been suitably recognised by the award of the title of "Khan Saheb" to Mr. Soofi, Manager of the Cotton Farm.

The success that attended our effort in growing cotton on a commercial basis at Tel Deir is very largely to be credited to the Manager of the Estate—Mr. Ghulam Hussain.

Mr. Gopal Singh, at the Cotton Farm, continued to be most helpful and resourceful.

I am glad to have this opportunity of expressing my gratefulness to Lieut.-Colonel Dent, D.S.O., Intelligence Branch, G.H.Q., for his kindness in affording exceptional facilities to the Tel Deir Cultivators both during the cultivation of the crop and during the transport of the Cotton to Baghdad.

ROGER THOMAS,  
*Cotton Expert.*

BAGHDAD,  
May 1921.





## APPENDIX IX.

## Report of the Baghdad Tree Nursery.

Mr. A. J. Glenister was in charge until July, 1920, when he proceeded on leave to U.K. and I took over charge.

Operations at the Tree Nursery were continued during the year in order to carry on the propagation of young trees and also the experiments which had been made with imported varieties of shade trees. The selection of these imported varieties required a good deal of consideration. The temperature of this country varies from approximately 115°F. in the shade in summer to approximately 25°F. in the winter and it is pleasing to note the number of varieties that have withstood both the heat and the cold. The following is a list of the trees that were experimented with and propagated during the year:—

*Salix* spp.—Willow.  
*Tamarix articulata*—Giant tamarisk.  
*Melia azedarach*—Persian lilac.  
*Pinus longifolia*.  
*Pinus cassia*.  
*Morus* spp.—Mulberry.  
*Sesbania aegyptiaca*.  
*Sisyrinchium* spp.  
*Myrtus communis*—Myrtle.  
*Terminalia tomentosa*.  
*Dalbergia sissoo*.  
*Eucalyptus* spp.  
*Albizia lebbek*.  
*Aralia*.  
*Bambusa*.  
*Prosopis* spp.  
*Bombax malabaricum*.  
*Populus* spp.—Gold Mohur.  
 Soap Nut Tree.

The following notes upon these species are given:—

*Salix* Spp.—Arabic “Safsaf” :—There are three varieties at the Nursery, i.e., the local willow, the graceful willow with red branches and the weeping willow from Quetta. Cuttings were taken from the first two mentioned and struck in the Nursery whilst cuttings of the last were received from India. All made excellent growth during the year reaching an average height of five feet. Foliage appears during the month of March and throughout the summer they flourished well. With the coming of winter all trees lost their leaves but have now commenced to make fresh growth. Experiments were made with regard to transplanting this variety and both transplants in the spring and the autumn have proved successful. The spring transplants, however, appear to be the better.

*Tamarix articulata*—Arabic “Ihl” :—Cuttings were taken from trees established in the locality of Baghdad and all have struck root. They have not, however, made the progress that was expected and during the year reached a height of about one and a half feet.

*Terminalia tomentosa*.—Experiments were made with both imported seedlings and seed. Both made good growth during the summer months during which an average height of four feet was reached. They were, however, cut back by the frosts but it is probable that they will make fresh growth from the roots with the advent of spring.

*Melia azedarach*—Persian “Lilac”—Arabic “Sibha” :—Seed sown in March produced seedlings four feet in height during the year which were unaffected by the frosts.

*Pinus longifolia*.—Those raised from seed sown in March, 1919, reached a height of 2 feet during the year under report. The growth of this species is very slow indeed but the young plants appear to be very healthy.

*Pinus cassia*.—The germination of seed sown in the spring of 1920 was poor and the few plants that were raised did not survive the frosts of November.

*Morus* spp.—Arabic “Tuth” or “Tukki”.—Seed was sown in March, 1920, and produced seedlings of about two feet in height. Trees raised from suckers taken in March, 1919, have now reached a height of 10 feet. It survives both heat and frost.

*Sesbania aegyptiaca*—Arabic “Sesban”.—This species grown from seed sown in February, 1920, reached a height of 15 feet before the cold weather set in. All trees, however, were cut down by the frosts of 1920. This tree makes most rapid growth during the hot season but a most mild winter is necessary to obtain established trees.

*Zizyphus* spp.—Arabic (Tree) “Sidra” (fruit) “Nabuk”.—Seed was sown in the early part of 1919 and during the year seedlings grew to a height of 10 feet. Towards the end of 1919 the majority of these seedlings were cut back and during 1920 reached an average height of 12 feet. Well established trees exist in Mesopotamia.

*Myrtus communis*—Arabic “Yas”.—Cuttings were taken during March, 1919, and struck in the Nursery. By the end of 1920 these had developed into small shrub-like trees of 2 feet in height.

*Dalbergia sissoo*.—Seed was collected from trees existing at G.H.Q., Baghdad, towards the end of 1919 and sown in March, 1920. Seedlings reached a height of four feet during the year and withstood the frosts. This tree appears to be well suited to the climate of the country.

*Eucalyptus* spp.—Two varieties were grown in the Nursery, i.e., *E. Citridora* and *E. Rostrata*. Seedlings of the former reached a height of 3 feet during the year 1919 but was cut back by the frost. In the spring of 1920 they shot up again from the roots and reached a height of 4 feet. The 1920 frosts, however, again cut same down but new growth has now appeared. The latter during 1920 grew to an average height of 8 feet and were untouched by the frosts.

In addition, the Australian blue gum, sown in 1919, during the year reached a height of 12 feet. The majority were pruned during the autumn to prevent excessive growth.

*Albizia lebbek*.—Seedlings received from India in April, 1919, were planted in the Nursery and grew to a height of four feet during the year. Some of the plants during the year were affected with a form of blight which caused the leaves to die.

*Aralia*.—A variety of this species was received from India in April, 1920, and planted out. Trees grew to a height of four feet during the year.

*Bambusa*.—Seedlings received from India in the spring reached a height of four feet during the year. They have been leafless during the winter but it seems probable that they will break out again with the advent of spring.

*Prosopis* spp.—Seedlings grew to a height of five feet and were cut down by the frosts of November, 1920. These, however, have now commenced to make new growth.

*Bombax malabaricum*.—Seedlings grew to a height of three feet during the year. Trees grown in 1919, which were affected by the frosts of that year, recovered and grew to a height of 6 feet. Roots of this tree are exceptionally long.

*Populus* spp.—Euphrates Poplar—Arabic “Gharab”. White Poplar—Arabic “Khawakh”.—Cuttings of the white poplar were planted in April, 1920, and grew to a height of 12 feet during the year. In the autumn of 1920 all young trees were pruned in order to arrest growth which appeared to be excessive for transplants. It strikes very easily from cuttings.

*Golden Mohr*.—Seed sown in the spring produced seedlings of five feet in height, which were killed by the frosts.

*Soap Nut Tree*.—Seed sown in the spring produced seedlings of three feet in height. They were leafless during the winter but have now commenced to make new growth.

In addition to these, the following varieties of fruit trees were propagated and did well during the year:—

- Fig—(Arabic “Teen”).
- Pomegranate—(Arabic “Rumman”).
- Peach—(Arabic “Khokh”).
- Apple—(Arabic “Tufah”).
- Quince—(Arabic “Haiwa”).
- Plum—(Arabic “Unjas”).
- Nectarine—(Arabic “Khokh”).
- Apricot—(Arabic “Mishmish”).
- Orange—(Arabic “Portukal”).



Several varieties of sugarcane received from Coimbatore were experimented with. These made rapid growth during the hot season. Cape Gooseberry was sown in May, 1920, and grew well during the summer. This, however, died with the advent of the cold weather with the fruits only half formed. This fruit, sown earlier, should do well. It will be tried again during the coming year. Colocaccias and Jerusalem Artichokes were also cultivated during the year and did well.

During the coming year further varieties of trees will be tried. Seed has arrived from India, Egypt and Australia and is being propagated. Cuttings and seed will be taken from trees already existing in Mesopotamia. As far as possible, all seedlings grown during the past year will be transplanted to their permanent sites.

Throughout the year the labour has consisted of one tindal and from two to four labourers, all of whom have worked well.

H. G. D. ROOKE,  
*In charge Nursery.*

BAGHDAD,  
24th March, 1921.











